MILL SECTION of
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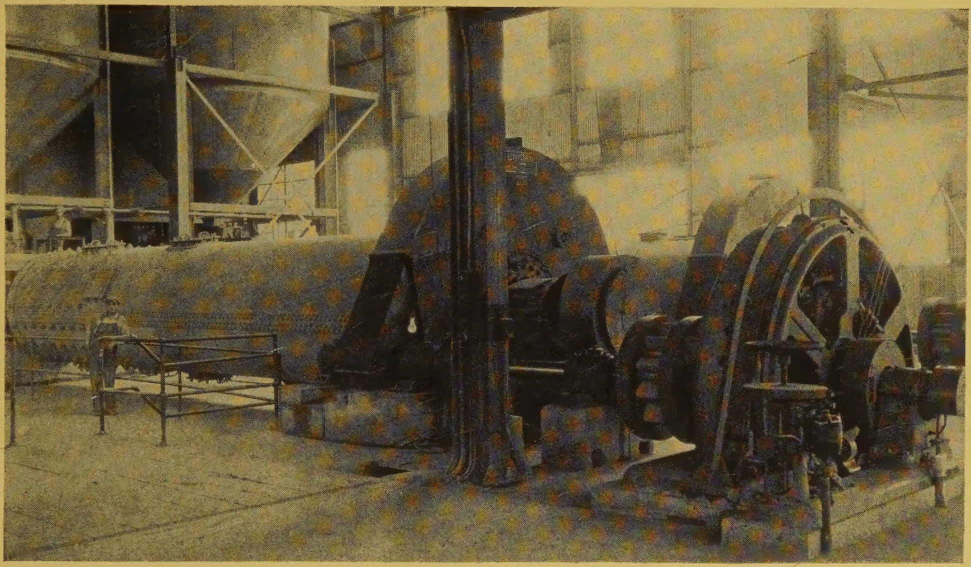

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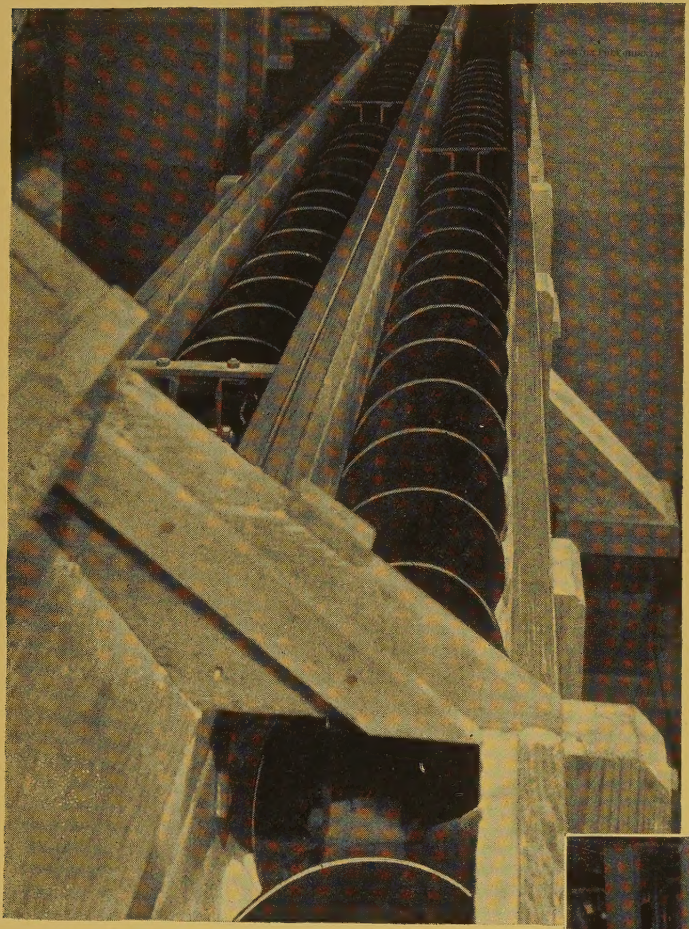
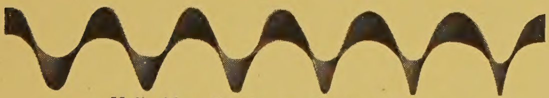
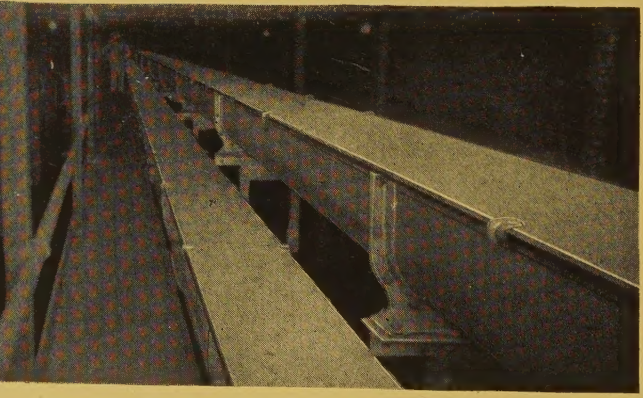


Helicoid Screw Conveyor Installation

Sectional Flights



Helicoid or Continuous Flight Conveyor



Typical Caldwell Screw Conveyor Installation

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MILL SECTION of Concrete

The Cement Mill Edition of Concrete is edited exclusively for those interested in the manufacture of cement. Its pages are devoted to discussions of plant design, management, operation, production efficiency, chemical research and control, quarry operation, progress and news of the industry.

The Cement Mill Edition also contains all the material published in the corresponding Regular Edition and so provides news of the uses and merchandising of the materials whose manufacture is discussed in the Mill Edition. The Regular Section furnishes mill operating officials and mill executives valuable points of contact with the users of the materials they produce.

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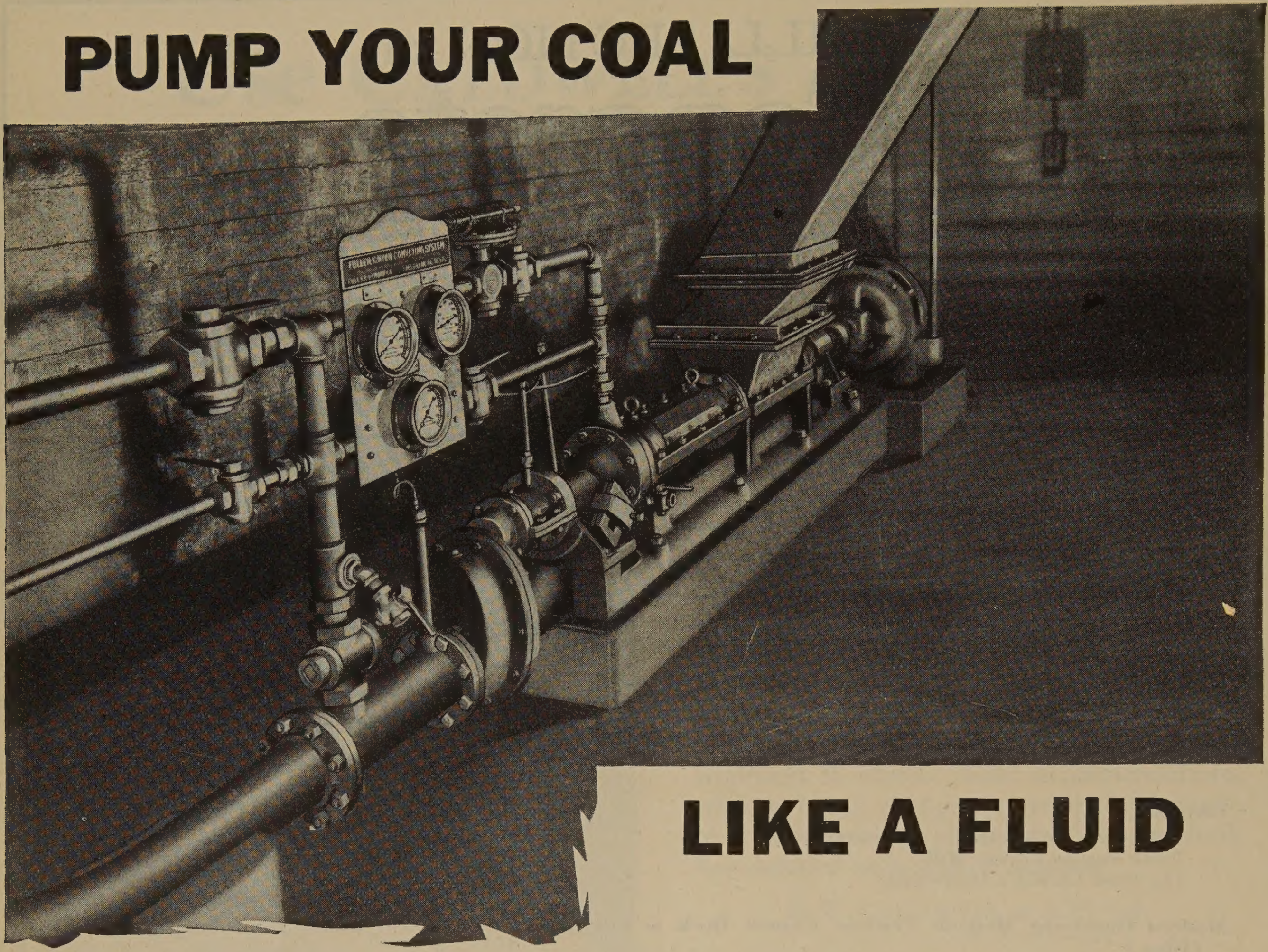

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MILL SECTION of
Concrete
Vol. 37 Chicago, October, 1930 No. 4

Southwestern's Laboratory *Equipped With* Dependable Apparatus

Four Major Items of Equipment Described—Use Mechanical Tamper for Mortar Test Specimens — Moist Room Has Constant Temperature — Prevent Ingress of Air in Free Lime Determination—Reactions Speeded Up —Air Elutriator Determines Size Distribution of Particles

By S. L. MEYERS
Chief Chemist, Southwestern Portland Cement Co., El Paso, Texas

IN the chemical control of cement manufacture the chemist is often puzzled in trying to understand his physical tests, such as soundness, setting time, and strength, from the chemical analysis. This is true of all those physical tests which directly affect other physical tests of the cement.

With the routine means we have had in the past it has often been difficult to explain even partially the variations in the properties of a cement. So in place of knowing we guessed or assumed the cause of a variation, with more or less luck. As our tools for determining tests become more adapted to obtaining the desired information, just in that degree do we progress toward understanding variations in our products; and though we are still enveloped in twilight as to a complete understanding of the qualities of cement, light is being shed on this subject in rapidly increasing brilliance, by the researches of the Portland Cement Association, the Bureau of Standards, A. S. T. M. activities, and many others engaged entirely, or partially, in research.

The writer has found the four pieces of apparatus described in this article to be of considerable help. None of them is entirely original with the writer, but all have been modified at this laboratory, and they are offered with the hope that they will help some others a step forward in the direction of the truth they are seeking.

In glancing over the strength results on one's daily routine tests of cement, and noting the peaks and depressions obtained, one may ask the question: Are these variations due to the manner of making up the test pieces, their storage, or to the cement itself?

Definite and appropriate specifications are given for the making, storing, and breaking of tension test pieces; but in spite of this, different laboratories, each apparently

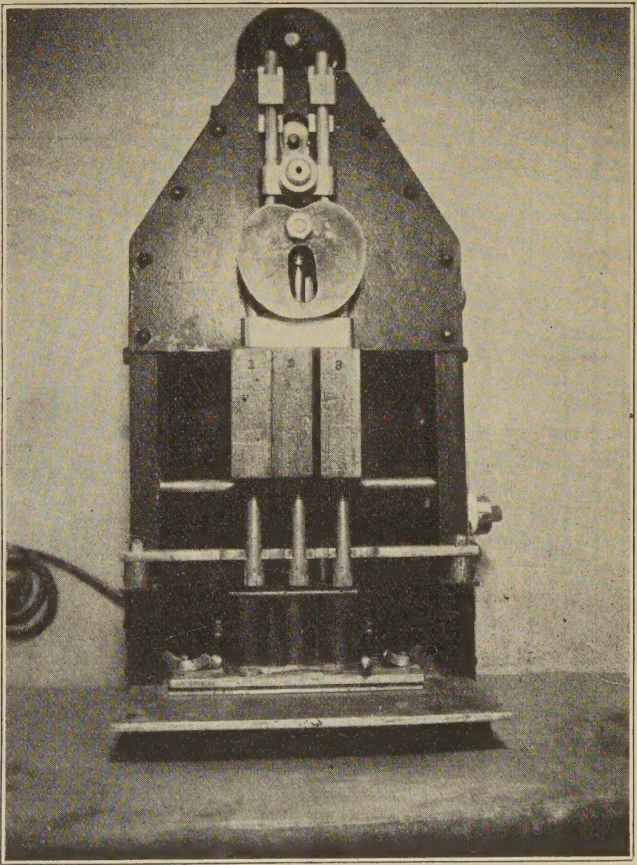


Figure 1. *Machine for tamping* 2 by 4*-inch mortar cylinder specimens* with a genuine desire to conform to these specifications, ~~vary widely in their~~ results on the same sample.

Mechanical Tamping of Mortar Specimens

dine

In Europe the tamping of mortar into the molds is done largely by hand. Europeans express surprise that our hand-tamped specimens are as uniform as they are, since they consider it impossible for a human operator to use identical pressures, and distribute them as uniformly, day after day, and year after year, as a machine can do it. Concrete mixes, being in a more plastic condition than sand mortars, are less sensitive to the quantity of work applied and the degree of pressure applied while working. Where care is used and uniform aggregates of the same kind can always be obtained, concrete tests are more consistent, and a better index of the strength quality of cement, than any other test. Unfortunately concrete requires an excessive amount of labor for routine tests.

Since the specifications cover hand-pressed tension briquettes, and only tentative specifications cover 2 by 4-in. cylinders of 1:3 sand mortar, we use a mechanical tamping machine for tamping the mortar into the molds. This machine was originally designed by the cement testing laboratory of the City of Los Angeles, where remarkably uniform results were obtained with it. The machine as we use it has been modified by this cement company's engineers.

Design of Tamper

The design of the cam, which raises and lowers the tampers above the mortar, is such that the tampers descend onto the mortar at the same rate, regardless of the height of the mortar in the cylinders; thus insuring the same impact pressure on the mortar with each blow of the tamper. The up and down velocity of the tamper is between 3 and 4 in. per second. Each tamper weighs 30 pounds, and makes 29 cycles per minute when operating. It has been recommended to put the mortar into the molds in one-inch layers and tamp each layer eight times. However, we get the same results by using 1 1/3-in. layers, with eleven tamps to each layer. This allows a slightly more rapid operation. A thin cap of neat cement is used on top of the mortar. When this hardens it is shaved off with a straight sharp edge to give a smooth uniform bear-

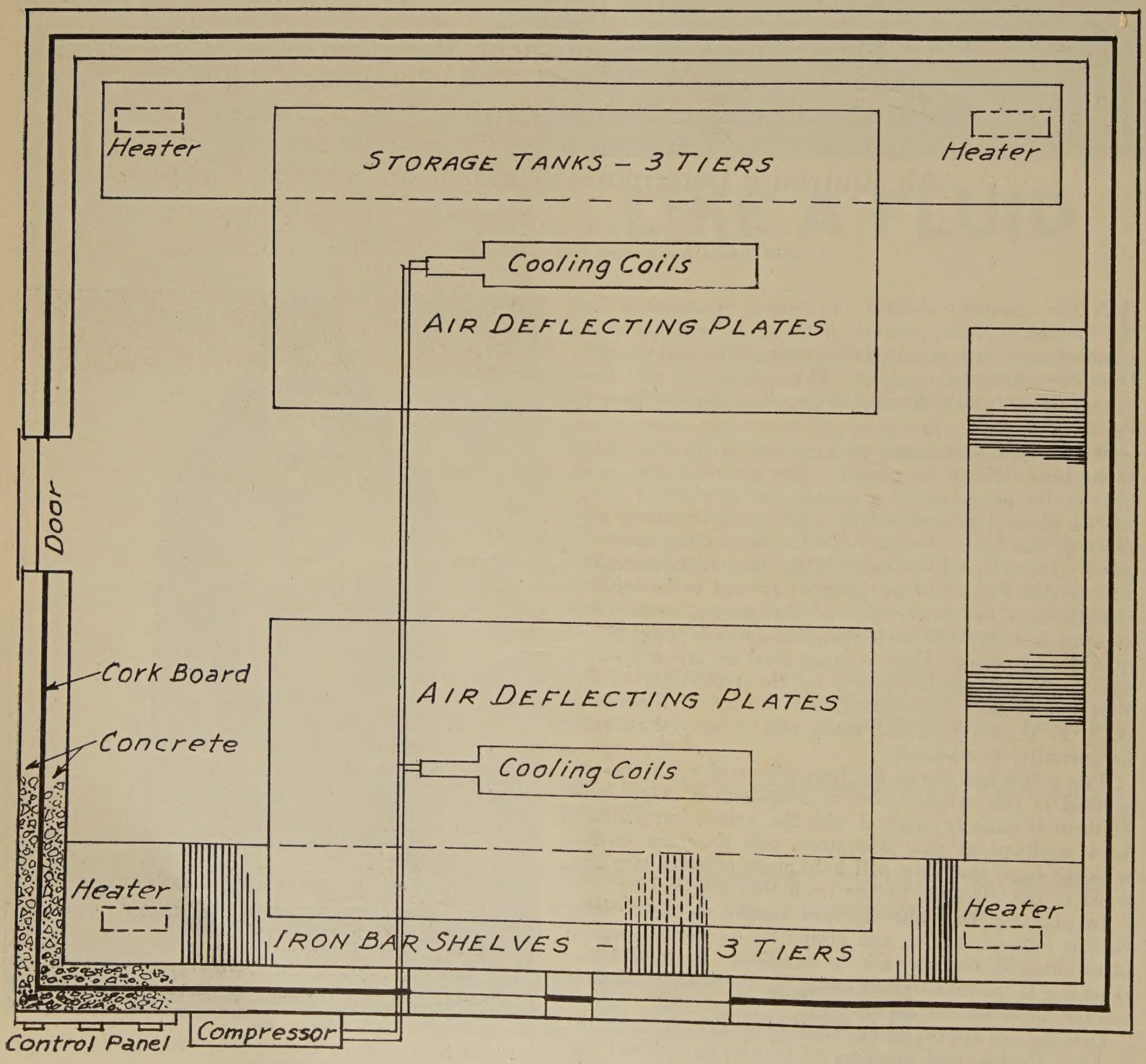


Figure 2. Plan of moist room

ing surface for breaking the specimens. All other operations of mixing and preparing the mortar and storing the specimens are performed in the usual way.

A Constant Temperature Moist Room

Temperature affects the rate of hydration, and therefore the rate of hardening, or gain of strength, in cement mortars. An increase of temperature accelerates this rate, while a decrease of temperature retards it. Further, the temperature may affect the rate at which some of the cement constitutents are leached from the mortar into the storage water; also the counter-effect of deposition sometimes occurs, and it also is affected by temperature variations.

The first 24-hour period of setting and hardening before placing the specimens into water is affected by humidity changes.

The accompanying sketches in Figures 2 and 3 show a constant temperature and humidity moist room for both air and water storage of specimens.

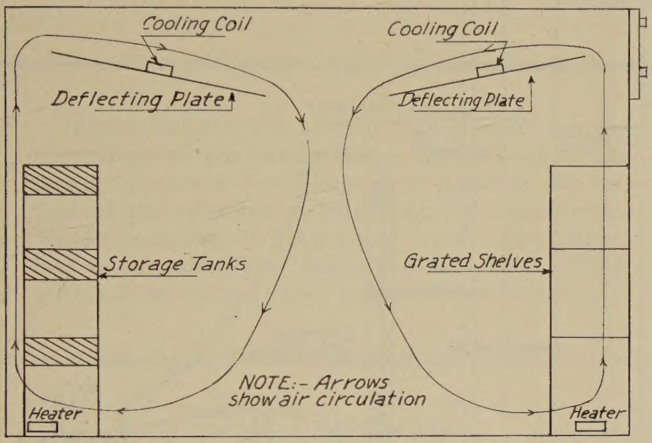


Figure 3. Diagrammatic cross-section of moist room

Extension bulbs filled with a high pressure liquid, sensitive to temperature changes, are located within the moist room. These bulbs operate mercoid switches which in turn operate either heaters, or a refrigerator, as the need may be. Both wet and dry bulb temperatures are automatically recorded on a hygrometer. Several fine mist water sprays keep the humidity of the room near 100 per cent. This arrangement has been in operation for nearly a year, and has given entire satisfaction. Regardless of weather conditions, variations of temperature and humidity are so small as to be practically non-effective on the cement mortar during storage. This eliminates the question: Did the temperature or humidity changes during the storage of the test pieces affect their strength or setting tests?

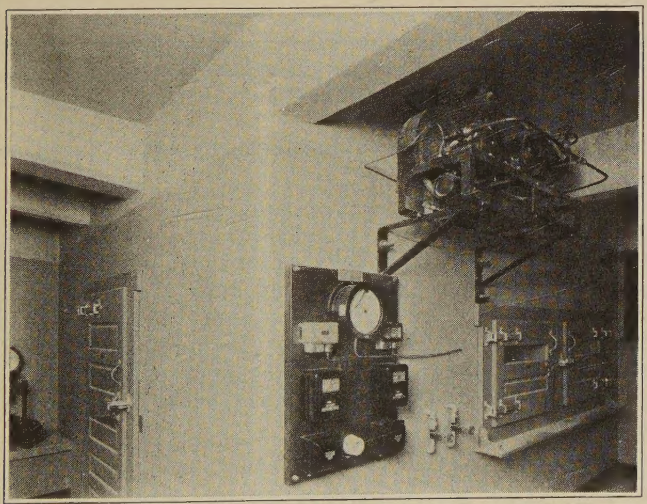


Figure 4. Exterior of moist room

The exterior of the moist room is shown in Figure 4, while Figure 5 is a close view of the instrument control panel shown in Figure 4.

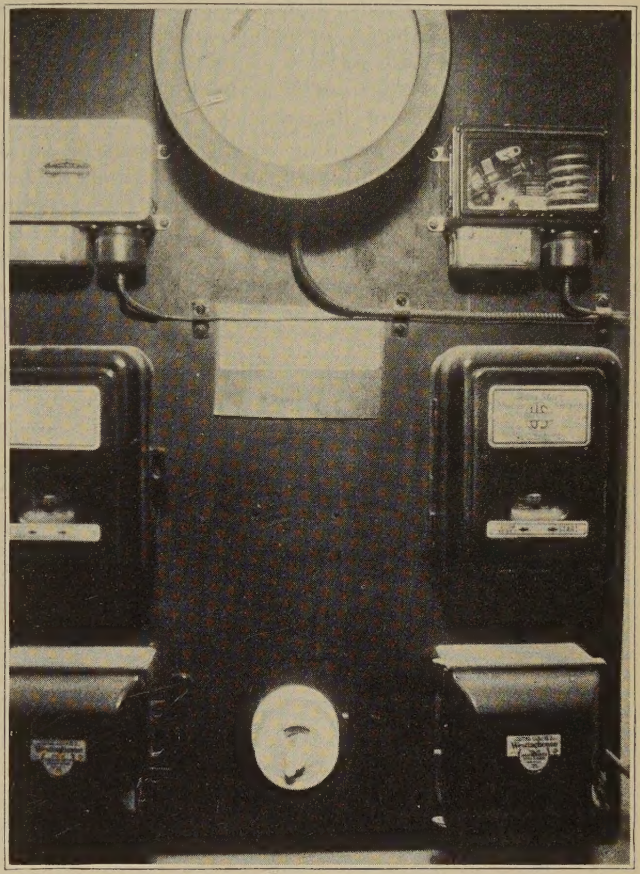


Figure 5. Close view of instrument control panel shown in Figure 4

Free Lime Apparatus

Perhaps no single determination has been more strongly desired, or sought for longer without success, then that for determining uncombined lime. The ammonium acetate method is the only one giving any degree of satisfaction. Its authors admit the necessity of keeping the air away from the reacting substances during the lengthy determination, but make no mention of any convenient apparatus for this purpose. Another objection to the method is its slowness, several hours being required for a single determination under average conditions.

The identity and composition of the major mineral constituents of clinker are fairly firmly established, but to calculate them definitely from a chemical analysis requires a knowledge of the amount of uncombined lime present. The accompanying sketch shows how the ingress of air is entirely prevented during the whole operation, while at the same time a mechanical shaker speeds up the reactions to about half the usual time.

For the sake of clarity only one determination set-up is shown, but the apparatus can be arranged to run several determinations simultaneously with one shaker, and one condenser containing several small copper reflux pipes.

Flour Determination by an Air Elutriator

In recent years there has been a tendency toward finer grinding of cement in an effort to obtain higher early strengths. It is generally conceded that early strength of cement is due to the presence of fine impalpable powder, and that the coarser particles of around 300-mesh size hydrate very slowly and only contribute to the strength of cement at later periods. For a given mineral constitution with the same degree of aging, and constant conditions of making and storing, it is probable that the strength of a cement at early periods is a function depending on the total surface area of its particles.

Many variations of grinding conditions cause a variation of the size distribution of particles, which a sieve can tell very little about. With our present fine grinding very little residue is left upon a sieve, and this tells little about the size distribution of the fines and coarse which make up the cement. An air elutriator will tell one about that part of the cement which is most influential in affecting its strength quality.

The air elutriator shown here is based on the principle and general design of the Pearson air analyzer. A smaller orifice, or jet, with a higher pressure up to the orifice, is employed for the purpose of making a greater agitating impact in the sample at the bottom of the cone. For particles with a given specific gravity the velocity of air up the stack determines the separation size. Here a fall of pressure across an orifice is a more exact measure of velocity then a gauge which measures static pressures; so an orifice meter is inserted between the air inlet and the jet. The air velocity is regulated by the mercury valve through which the excess air escapes. Different working pressures, with different stack velocities having different particle separation sizes, are obtained by varying the height of the mercury column through which the excess air escapes.

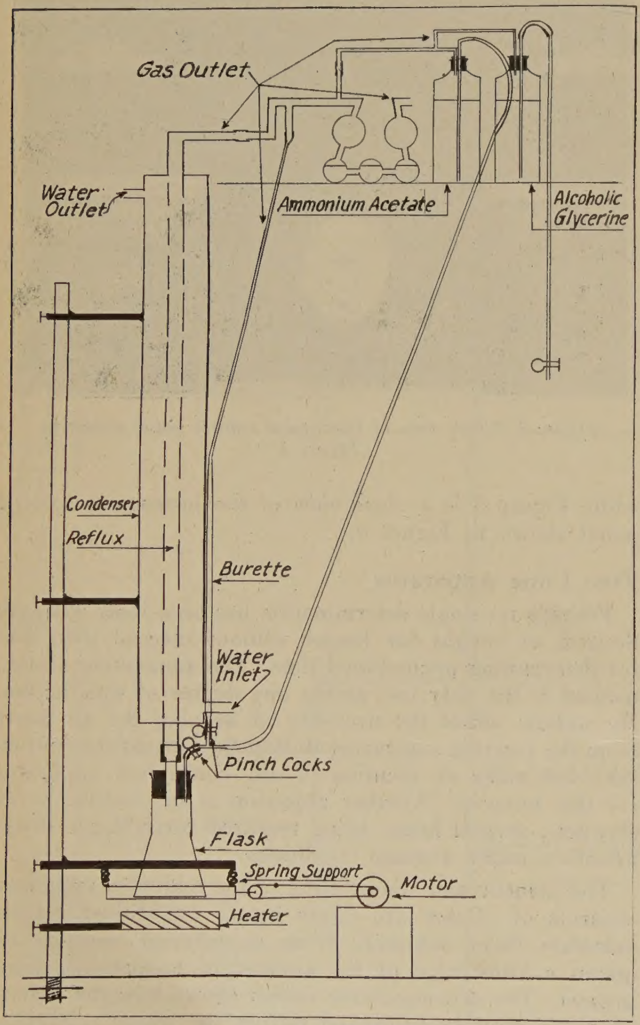


Figure 6. Apparatus for determining uncombined lime

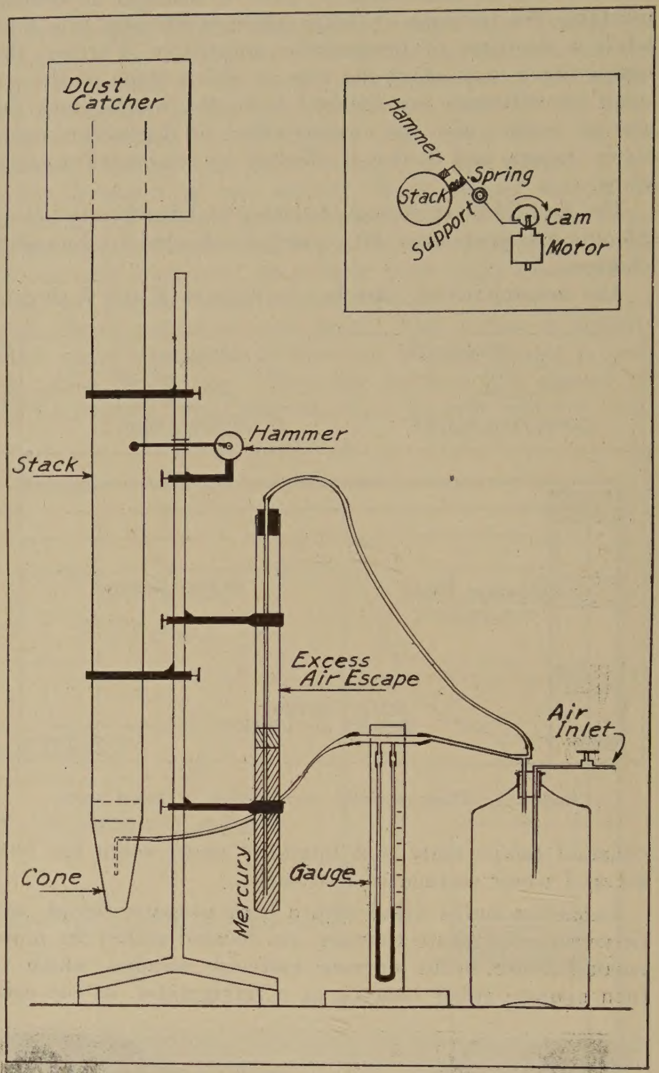


Figure 7. Air elutriator for determining fineness and size distribution

Fine dust has a tendency to stick on the inside surface of the stack, due partly to adhesion and partly to electrostatic charges. Ordinarily buzzers, or rapid tappers, are used to dislodge this dust and make it fall back into the air stream for further separation. Sometimes their noise is annoying. To overcome this nuisance we use a small electric motor with reduction gears which works an eccentric cam attached to a hammer which hits the stack at regular intervals.

Largest Australian Plant Goes Into Operation

The new cement plant of the Goliath Portland Cement Co., Ltd., at Railton, Tasmania, and the most modern of its kind in Australia, was recently placed in operation. It has a production capacity of 80,000 tons of cement annually, trebling that of the old plant.

The Chemistry of Portland Cement Manufacture

Forms in Which Sulphur Occurs in Raw Materials—Sulphur Absorbed from Coal and Fuel Oil—Analysis of Materials Throughout Length of Rotary Kiln — Why Presence of Sulphides Leads to Unsoundness

II—Effect of Sulphur (S) and Its Compounds—Part One

By **ALTON J. BLANK**
General Superintendent and Supervising Chemist, Compania de Cemento Portland "Landa," S. A.,
Puebla, Puebla, Mexico

In this article, the second of his series on the chemistry of portland cement manufacture, the author presents Part One of a detailed discussion of the effect of sulphur and its compounds. These compounds may occur in the raw material or be absorbed from the fuel. Part Two will follow, in our next issue.—The Editors.

THE sulphur content of portland cement is due, for the greater part, to the addition of gypsum or other sulphur-containing materials to the burnt clinker before grinding to cement.

The sulphur content of portland cement clinker may be due to a number of causes. The amount of sulphur present in the raw cement materials, the manner in which these materials are burnt in the kiln, the type of kiln fuel employed, all are important and contributory factors.

In the production of portland cement clinker where the initial raw cement mixtures contain sulphur, and in the burning of the clinker where sulphur-containing coal or oil is used as the fuel, the writer has yet to analyze a clinker that does not contain sulphur in one of its forms.

Forms in Which Sulphur Occurs

Sulphur is commonly present in a few of the raw materials suitable for portland cement manufacture, in one of two forms, such as calcium sulphate ($CaSO_4 \cdot 2H_2O$), or as iron disulphide (Fe_2S). The presence of sulphur in the limestone component of the raw cement mixture is usually confined to the gypsum, or calcium sulphate form, though in one freak deposit of limestone the writer has found it to be present as calcium sulphide. The presence of sulphur in the clay component of the raw cement mixture is usually confined to the mineral pyrite, iron disulphide, though in certain deposits of clay the writer has found it present as calcium sulphate. In slags utilized in cement manufacture calcium sulphide (CaS), ferrous sulphide (FeS) and calcium sulphate all may be found in small quantities in the air-cooled variety. However, those slags that are quenched in water have the greater part of their sulphur content evolved as hydrogen sulphide (H_2S).

Should Avoid Raw Materials Containing Sulphur

Regardless of the form in which sulphur may occur in the various raw materials suitable for cement manufacture, its presence is to be considered as detrimental, rather than as beneficial, or even inert, and to that end sulphur-containing raw materials are to be avoided wherever possible.

While it is certainly possible to manufacture portland cement from sulphur-containing raw materials, it is not always possible to manufacture a cement of the best quality. Recognition of this fact is to be found in the cement manufacturing projects which have been abandoned in past years through failure to find more suitable raw materials, and in several instances where operating cement plants have definitely closed down on finding that the use of sulphur-containing raw materials results in certain difficulties encountered in manufacture, and in certain undesirable features which are found in the resulting cement.

Those cement companies utilizing sulphur-containing raw materials are few, and the result is that no great amount of data covering this subject has appeared in the trade journals. Similarly, little in the way of information is found through perusal of the several books written on portland cement manufacture, since the subject is apparently thought to be of little importance, and is dealt with as such. The writer's studies in this connection cover a variety of materials and conditions; and this experience, together with the conclusions he has formed, is given for what it may be worth to the reader.

Sulphur Absorbed from Fuels

In coal and oil fired dryers it has been found that sulphur-free raw materials, in their passage through the dryers, have an affinity for the absorption of a part of the fuel sulphur; and while the amount of sulphur absorbed has been found to be as low as 0.10 per cent SO_3, it has, on occasions, been found to be as high as 1.0 per cent SO_3. In soft limestones and with clays, this absorption has been found to average 0.35 per cent of SO_3.

In coal and oil fired cement kilns it has been found that sulphur-free raw mixtures, in their passage through the kiln and conversion to clinker, also have an affinity for the absorption of a part of the sulphur present in the fuel, though it has been found that certain raw mixtures have a greater affinity for the absorption of the fuel sulphur than do others. In the combustion of coal and oil the flame is usually oxidizing in character, though not always so. When oxidizing burning conditions prevail—that is, when the fuel is burned with an excess of air—there is invariably a tendency for the retention of a large amount of the sulphur of the fuel in the materials being dried or burnt. In the case of dryers an oxidizing condition practically always prevails, while in the case of cement kilns, quite often a reducing condition is encountered.

In the combustion of fuel oil or coal in the rotary cement kiln its sulphur is converted into sulphurous acid gas, which, when in contact with magnesia, or calcium and air, becomes sulphuric acid and unites with the former to form magnesium sulphate, and with the latter to form calcium sulphate. These salts are produced by oxidization of these minerals during the burning process. Thus, with an oxidizing condition present in the kiln, that sulphur which would be found present in the clinker would be in the sulphate form. However, in event the flame were not sufficiently oxidizing in character, and a reducing atmosphere prevailed, these sulphates would be reduced to sulphides.

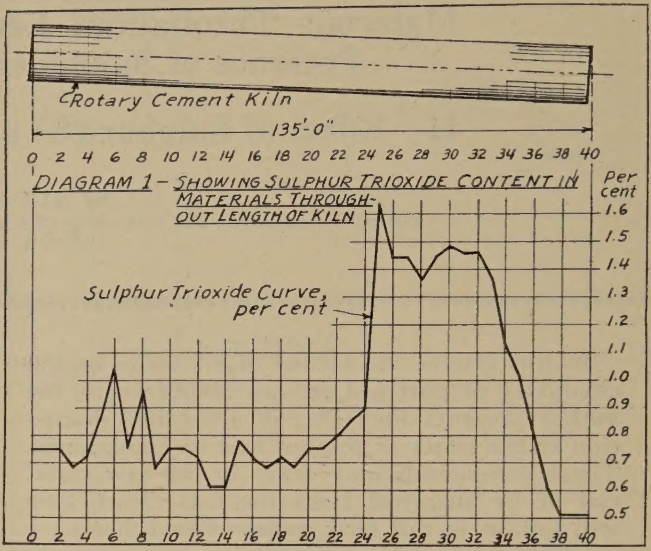
Theoretically, raw materials containing calcium sulphate, in their passage through the kiln, are dissociated from calcium sulphate ($CaSO_4$) into calcium oxide (CaO) and sulphur trioxide (SO_3), the latter being carried out of the kiln by the waste gases. Should a reducing atmosphere prevail, the calcium sulphate would be reduced to sulphide form.

Analyses of the materials throughout the length of a rotary kiln, its dust chamber, and from hoppers situated throughout the waste heat boiler system, made possible by a mechanical breakdown that did not permit of further operation, and left the materials undisturbed, revealed certain interesting data in connection with the manufacture of portland cement from materials averaging 0.72 per cent SO_3, and the use of fuel oil containing 5.5 per cent sulphur (S). The analysis just mentioned is shown in Diagrams Nos. 1 and 2.

Diagram No. 1 shows the sulphur content of the materials in the kiln, and Diagram No. 2 shows the sulphur content of the materials throughout the waste heat system.

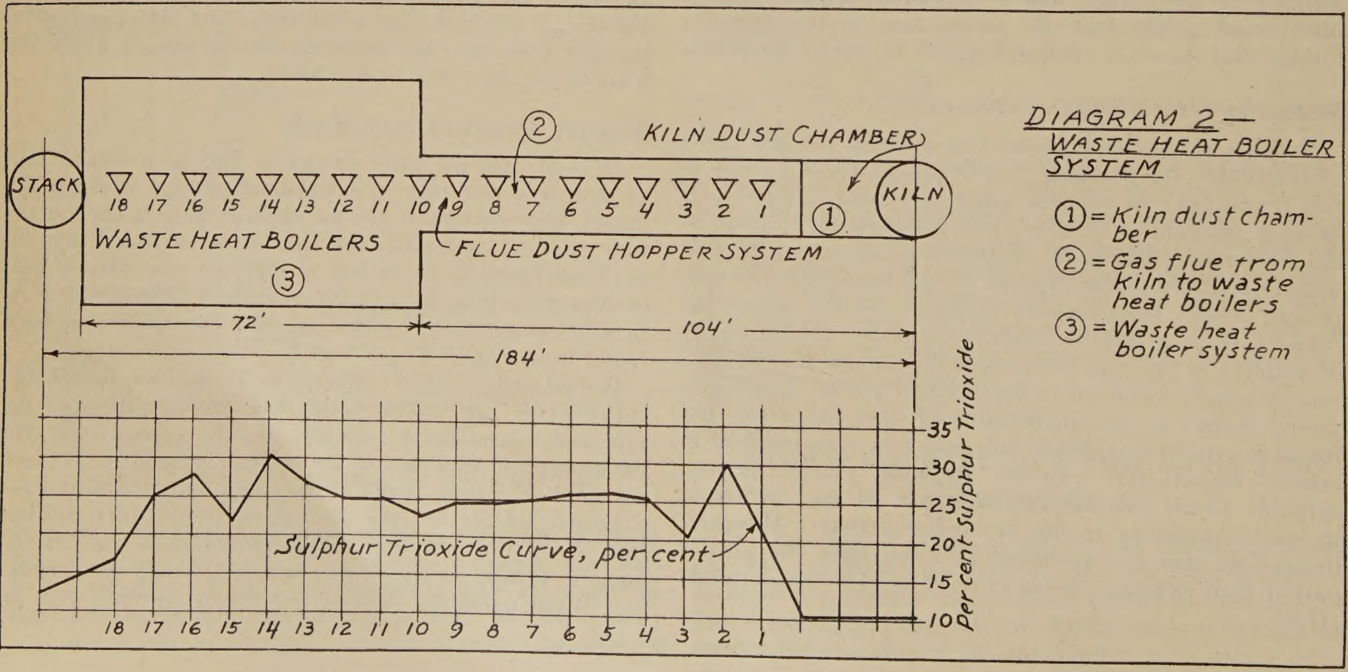
Perusal of Diagram No. 1 shows the more or less regular percentage total of sulphur present in the raw mixtures starting at the feed end of the kiln and continuing on to point 24. Analysis of this material revealed no presence of sulphur sulphide up to point 24. From point 25 in the kiln to point 34 sulphur sulphide was found to the extent of 0.090 per cent. From point 34 to point 40 at the discharge end of the kiln the presence of 0.058 per cent of sulphur sulphide was found, thus showing that a reducing atmosphere was had in the kiln at the time it was abruptly stopped.

Perusal of Diagram No. 2 shows the great concentration of sulphur between point 1 and point 17 in the waste heat system. Analyses of the material between these points shows an average of 0.420 per cent of sulphur present as sulphide. Analyses of the material situated between point 17 and the kiln stack show an average of 0.189 per cent of sulphur sulphide.



The large sulphur content of the materials as shown in Diagram No. 1 between point 24 and point 34 of the kiln would suggest that the concentration were due to (1) concentration of the sulphur present in the mixtures and (2) greater affinity of the materials for the absorption of fuel sulphur between those points at the prevailing temperature.

The large sulphur content of the materials situated throughout the waste heat system, Diagram No. 2, would



suggest that the sulphur carried out of the kiln by the waste gases, on reaching the cooler section of the waste heat system, was precipitated as sulphates and reduced in part to sulphides through the reducing atmosphere prevailing.

At one other plant the analyses of materials throughout the length of several kilns showed the presence of sulphur, a part of which was present as sulphide. The same was true of flue dust caught in the kiln dust chambers. While the initial raw mixtures contained no trace of sulphur, the fuel oil as used contained sulphur in excess of 4.0 per cent.

This would tend to show that raw mixtures containing no sulphur, when burned in kilns utilizing sulphur-containing fuel, have a tendency toward the absorption of sulphur.

Experiments with clinker over a period of several years have shown that clinker containing sulphide, upon being quickly cooled in water, turns bluish as to color, though at times certain clinkers have been found to turn yellowish and greenish as to color, and show sulphides.

The writer's experience with materials high in sulphur content has been to the end that they are hard to burn in the kiln; and even though burned hard at a sacrifice in fuel and kiln output, the resulting product is found to verge upon unsoundness, to yield excessive expansions as determined by the Le Chatelier method, and to yield poor strengths. Apparently well burned clinker, on being broken open, has shown soft centers containing as high as 4.0 per cent SO_3, a part of which would be sulphur sulphide. Other apparently well burned clinkers have been found to crack open after several days' storage, and examination of these clinkers has shown a number of yellowish-white blotches which, when picked out of the clinker, have been found to analyze as high as 34.0 per cent SO_3. Clinker of this type on being ground to cement has been unsound and has shown disintegration in the briquettes after three months.

Unsound cements containing sulphur sulphide have unusually high expansions and upon pats being removed from the "boil" have been found to have bloated to twice their original size. Color of the pats is usually bluish to brownish, depending on the sulphur sulphide content.

With cements high in calcium sulphide the writer has noticed abnormal expansions in the "boil" amounting to as great as 80.0 m/m, and these cements, while showing comparatively low strengths at ages up to 28 days, have been found to retrogress badly thereafter, and, upon breaking of the briquettes, greenish to bluish fractures are noted.

The explanation of the great expansion found in cements high in sulphide sulphur is that these cements, in neat or mortar form, upon exposure to the air and the humid atmosphere found in the "boil" or steam bath, oxidize to sulphates with a great change in volume which causes disintegration.

In the writer's opinion, unsoundness in cement caused by sulphur sulphides is a more dangerous factor than free, or uncombined lime, since the expansion is much greater and the retrogression in strength more consistent and rapid.

Northwestern States Plant Closes Down

The Northwestern States Portland Cement Company plant at Gilmore City, Iowa, closed its plant in the middle of August after several months of continuous operation.

Safety Work at Louisville in Hands of Operating Departments

Quarry Has Exceptional Record of 74 Months Without Lost Time Accident—Responsibility on General Foremen, Sub-Foremen and Workmen

Safety work at the Speed, Indiana, plant of the Louisville Cement Co. has been conducted on an extensive scale for about eight years. Formerly the plant was subdivided into nine safety divisions with men of similar occupation grouped as near together as possible. Each division had its own safety captain and first-aid squad. Monthly meetings were held by these divisions, and speakers and personnel men of the plant brought safety education to these men as a unit. All safety work was carried on by the personnel department, consisting of the plant superintendent, chief clerk, and first aid men. Various safety contests and campaigns were arranged to stimulate interest.

In 1928 it was decided to place this safety work on a production basis, and the work was turned over to the operating departments. There are now three divisions consisting of the quarry, including the Brixment and portland quarries and the stripping operation; the kilns, including the breaker, mill, and packing house; and the carpenters, iron workers, repair men, locomotive and track men.

Each division meets monthly and reports and discusses unsafe conditions and practices. They make suggestions and reports which are subject to veto by the superintendent, but only after thorough study and careful explanation to support the veto.

This move was made because it was felt that over an 8-year educational period the men have become well enough acquainted with the work to carry it on themselves. The responsibility has been placed on the general foremen, sub-foremen, and the man himself, and the men shoulder the responsibility well. As an example, the quarry division has gone 6 years and 2 months without a lost time accident. This is believed to be the most outstanding record in the country to date.

Two Western Regional Meetings in September

The third Pacific Coast regional safety meeting and first aid contest was held at the Palace Hotel, San Francisco, California, on September 16th under the auspices of the Portland Cement Association. The United States Bureau of Mines, the Society of Safety Engineers of California, and the National Safety Council co-operated.

The Northwest regional safety meeting, held at the New Washington hotel, Seattle, Washington, September 9th, met under the auspices of the Portland Cement Manufacturers of the Pacific Northwest, sponsored by the Portland Cement Association. This was an all-day session, attended by representatives of seven companies.

Sixty-Nine Quarry Men Awarded Stone Assn. Certificates

Sixty-nine men employed at the Speed, Indiana, quarry of the Louisville Cement Company were awarded National Crushed Stone Association certificates of honor on August 13th, rewarding 6 years', or 900,000 hours', operation without lost time accident.

H. D. Baylor, vice-president of the company, was the principal speaker at the ceremony, held at the community house.

Developments in Cement Manufacture in Britain

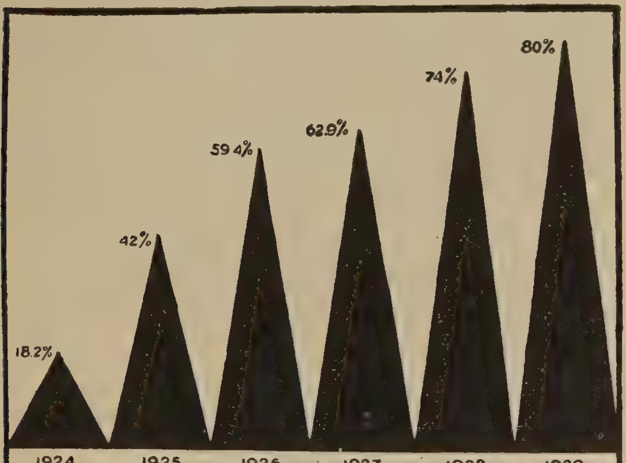
Last Twenty-One Years Show Great Progress in Quality and Manufacturing Methods—Present Output Compared with 1907

A REVIEW of the portland cement industry of Great Britain and Ireland appears in the Twenty-First Birthday number (July, 1930) of the monthly publication *Ferro-Concrete.* The review, which covers more especially the past 21 years, says in part:

"In 1909, manufacturers had awakened to the fact that old-fashioned English methods had outlived their day, and were actively engaged in building modern cement works and installing modern plant with the object of producing uniformly high grades of cement at minimum cost. The multifarious, divergent and contradictory specifications prepared by independent engineers relative to the composition, strength and testing of cement, had then been superseded by the British Standard Specification, and the industry had fairly entered upon the period of progressive development which led to the efficient and highly organized position it occupies today.

Reorganization of Works and Equipment

"Twenty-one years ago the old bottle and chamber kilns for burning had given way to small rotary kilns with an output of one or two tons an hour, and these have since been replaced by rotary kilns, up to nearly 400 ft. long by 11 ft. or more in diameter, with an output exceeding 15 tons an hour. The inferior quality of the product from intermittent kilns has given place to the superior and more regularly calcined product from rotary kilns, thus conducing in no small measure to raise the standard to the high pitch characterizing the cements of today.



Increased consumption of cement in Great Britain and Ireland over the consumption for the year 1907

"Plant for manufacturing purposes has been developed in line with successive improvements in quality. For instance, the increasing use of mechanical excavators for raw materials has inevitably followed augmented outputs, while appliances for mechanical and chemical control at all stages of manufacture result in the constant and regular composition of the mixture of raw materials which is a very prominent feature today. The old clinker-grinding mills have been replaced by the two-unit ball and tube mills, and in many works by the single-unit combined mill, while flint pebbles formerly used as a grinding medium have been superseded by steel grinding bodies.

"Ferro (reinforced) concrete silos for cement storage, and machinery for packing cement into sacks and casks have appeared during recent years, while slow-running steam engines, gas engines and complicated installations of shafting and belting have passed away in favor of turbo-generators and electric motors, power being generated at the works for operating the whole of the mechanical plant as well as for lighting purposes.

Continued Advances in Output and Quality

"The past twenty-one years of portland cement manufacture have witnessed a remarkable expansion of output and a revolutionary improvement in the quality of cement. In 1909 the total annual output of the country was about two million tons; today it is nearly five million tons. Finely ground cements were then those giving a residue of less than 18 per cent on a sieve of 180 meshes per inch. Today, cement is so finely ground that it cannot be gauged adequately even by tests on a 180 mesh sieve, and some form of air or fluid separator is being advocated for the accurate determination of fineness, a factor whose importance in relation to quality is now fully appreciated. In the year mentioned, the tests for the tensile and crushing strengths of portland cement were substantially satisfied with what are today considered to be low results, easily doubled by those obtainable by modern cement.

"Thanks to these characteristics, more satisfactory concrete can be obtained with smaller proportions of cement to sand and aggregate than those necessary in the past. In the United Kingdom, the manufacture of cement is conducted under strictly scientific and chemical control, with the aid of machinery, plant and processes which are continually being improved with the object of attaining still greater perfection in the selection and mixing of the raw materials, in their subsequent calcination, and in the final grinding of the resulting clinker to an impalpable powder."

Boiler Horsepower and Mechanical Horsepower Defined

Writer Explains Reasons for Difference Between the Two—Boilers Improved Faster than Engines

By W. F. SCHAPHORST, M.E.

CONSIDERABLE confusion exists regarding the relationship between a boiler horsepower and the horsepower of an engine or motor.

Surprising as it may be, a boiler hp. is 13.2 times as great as a mechanical hp. Here are the actual figures:

One boiler hp. = 33,479 B.t.u. per hour.

One mechanical hp. = 2,544.6 B.t.u. per hour.

The reason for this great difference is that in the early days when boilers and engines were first made and used, a 100 hp. boiler was called a 100 hp. boiler because of its ability to supply enough steam to run a 100 hp. engine. A 200 hp. boiler could furnish enough steam to run a 200 hp. engine, and so on.

But boilers are much more efficient now than they were in the days of James Watt. There has been such an improvement that today a 100 hp. boiler will easily take care of a 250 hp. engine. It is a fact even today that a boiler hp., according to the modern definition of a boiler hp., is 13.2 times as great as a mechanical or engine horsepower.

It is evident that formerly, when one boiler horsepower produced one mechanical horsepower the efficiency of conversion was only 1 ÷ 13.2 = 7.6 per cent. In other words, only 7.6 per cent of the heat energy in the steam was converted into work. Today the best plants show efficiencies that are much greater. According to my files the highest reported record is 27 per cent.

~ EDITORIAL ~

A Triumph for Mechanical Equipment

SELDOM is the opportunity offered for a clean-cut comparison between costs of production under the old hand-labor methods and under modern methods employing mechanical equipment to the fullest practicable extent.

Such a comparison—and one that tells a most surprising story—is made available in the figures supplied by H. D. Baylor, vice-president and works manager of the Louisville Cement Company's plant at Speed, Indiana, in the abstract of his paper printed elsewhere in this issue.

In 1897 it cost the Louisville Cement Company an average of $1.34 per ton to produce natural cement rock in the upper level of its quarry. The labor cost was 80.5 cents per ton, or 60 per cent of the total. In that year the average quarry force consisted of 35 men. The average hourly wage for the 35 men was 13.8 cents.

In 1929 the average cost of producing natural cement rock was 26½ cents per ton, of which the labor cost was just under 11 cents per ton, or 41 per cent of the total. In the same year the cost of quarrying the portland cement rock lying at a lower level in the same quarry was 32 cents per ton, the labor cost having been 9 cents per ton, or 28 per cent of the total. The hourly wage scale of the 40 men comprising the quarry force in 1929 was 53¾ cents.

Here is a direct comparison that demonstrates clearly the triumph of modern mechanical equipment over old hand-labor methods. But however marvelous the development of mechanical equipment may have been during the period covered by this comparison, let no one be lulled into the belief that the maximum has been reached. Things are now moving faster than ever before, so that plant executives must expect soon to have the modern equipment of today supplanted by still more efficient mechanical creations. The fortunate feature of this development is that each step moves in the direction of lower production costs.

Those Russian Cement Mills

THE recent excitement over the charge that the Russian government has undertaken to manipulate the American wheat market has started discussion of the probable effect on American and Canadian wheat growers when wheat production, with American-made machinery, is under full swing in Russia.

Quite probably some American cement manufacturers have been thinking about the possibility of having Russian portland cement dumped on the American market when the cement mills now under construction in that country are in operation.

The fact that American cement-making machinery is being installed in some of these mills is not in any sense a cause for criticism. If the equipment could not be bought here it would be bought in Germany or France or England. The main points of interest to American cement manufacturers are the questions as to whether the Russian mills can produce cement of high quality, and at what cost they can produce it.

Reassurance on these points may be seen in the opinions recently expressed by several well-known American financial writers.

Grain producing activities, it is pointed out, have been more successful than manufacturing operations. Even in coal production the Russians are having their troubles, for the output has never been up to the estimates, and in July some 25,000 workers walked out of the coal mines in the Donetz basin. The newspaper Izvestia complains that the whole program of soviet factory operations has been held up by the lack of coal.

The progress of cement manufacture in Russia will bear watching, with special reference to the exporting policies of the Russian government. At this moment it does not seem probable that the cement industry in the United States and Canada can be seriously affected. The effect in countries contiguous to Russia may be a more serious matter.

The Plant Chemist's Opportunity

NOW that the seasonal reduction in cement production is approaching, the time is here for thinking about the attainment of further improvements in the product of individual mills.

All mills have their laboratory facilities for carrying on the daily routine work, checking up on conditions at various points in the process of manufacture.

The plant chemist's time is fully occupied with this routine. Yet in spite of the vast research activities of the Portland Cement Association and the main laboratories of the larger cement companies, the individual plant chemist is the man who is most familiar with the product of his own mill.

At the present time one plant chemist is about to conclude two years of experiments which have resulted in a large increase in the volume of chemically active particles. Another is experimenting with means of lowering the temperature of calcination.

The enterprising plant chemist can do much in the next few months to improve the quality and uniformity of the product of his mill, thereby strengthening its position in the coming competition.

Employees Show Increased Interest in Suggesting Improved Methods of Doing Work

General Electric Company Adopts One-Third of Suggestions Submitted—Employees Paid for Ideas—How Suggestions Are Received and Considered

There is always a better way to do the job. That workmen show a keen interest in trying to find that better way is indicated by the results obtained by the General Electric Company for the first six months of this year. The sum of $56,974 was paid to employes during this six-month period for suggestions of plans to improve their jobs, this payment amounting to an average of $10.15 for each of the 5,616 suggestions adopted.

Payment Made for Suggestions Adopted

For the first half of the present year a total of 17,474 suggestions were made and 5,616 were adopted, as compared with 13,200 offered the first six months of 1929 and the adoption of 3,953, for which $49,586 was paid to employes. This latter sum amounted to an average payment of $12.54 each for the suggestions adopted.

All employes of the company are urged to submit suggestions for improvements and constructive criticisms on anything the company manufactures. This results in a constant improvement in the quality and efficiency of the products and the methods of manufacture.

How Suggestions Are Received and Considered

Suggestion boxes are distributed throughout the various buildings, and blanks are provided on which an employe may write his suggestion. If any employe desires assistance in drafting up his idea, it is furnished by the company. A suggestion is first referred to the head of the department which manufactures the material to which the suggestion refers. He reports in writing to a suggestion committee, which represents the manager. This committee reviews the report submitted and makes an independent investigation, so that a double check is made on all suggestions.

Deal with Manufacturing Methods and Design of Products

More than ninety per cent of all suggestions submitted during a period covering the past several years related to improvements in manufacturing methods or in the design of the various products made by the company. The remainder related to safety, improvement in working conditions, and similar subjects. It is noteworthy that nearly one-third of the suggestions received are considered of sufficient value to be adopted.

Universal Atlas Plant Releases Balloon For Each No-Accident Day in Safety Program

As a part of its safety program celebrating 955 consecutive no-accident days, the Duluth plant of the Universal Atlas Cement Company on August 20th released a like number of colored ballons.

Each of the balloons carried a tag bearing a brief safety message, a "Safety Crusader" badge of the National Safety council and a reproduction of a safety poster. Prizes were offered to the finders of balloons traveling farthest from the Duluth plant. Each tag also carried the name of an employe, and prizes were awarded to the employes whose balloons traveled farthest.

At the same time the safety trophy won by the plant for going through the calendar year of 1929 without an accident was unveiled. Mayor Snively and R. J. Fisher, president of the Advisory Public Safety committee, both of Duluth, were special speakers.

The trophy, which this plant has now won three times, was presented by George A. Ricker, representing the Portland Cement Association, and Fred Robinson, assistant superintendent of the Duluth plant, replied in accepting the trophy.

Commerce Statistics Show Decline in Cement Imports

The following statistics, furnished by the Department of Commerce, show the imports of hydraulic cements in June by customs districts of entry and the United States exports of hydraulic cement in that month.

July imports, in a later report, are shown to have dropped to 12,404, contrasting sharply with the 182,098 barrels imported a year earlier.

Imports of Cement by United States Customs Districts

	June 1 to 17		5 mos. & to June 17		June 17 to 30		6 mos. 1930	
	Bbls.	Value	Bbls.	Value	Bbls.	Value	Bbls.	Value
Florida			3,450	$ 3,828			3,450	$ 3,828
Los Angeles	312	$ 658	146,407	100,205			146,407	100,205
Maine & N. H.			779	1,793	8	$ 27	787	1,820
Maryland			25	39	155	174	180	213
Massachusetts	46,446	58,824	161,519	210,431			161,519	210,431
New Orleans	1,200	1,405	4,700	5,620			4,700	5,620
New York	3,700	8,056	93,040	114,251	19	72	93,059	114,323
Oregon			3,000	3,588			3,000	3,588
Philadelphia			93,523	114,391			93,523	114,391
Porto Rico	3,050	4,074	137,218	189,825			137,218	189,825
San Antonio			6,300	6,429			6,300	6,429
Hawaii					253	98	253	98
Total	54,708	$73,017	649,961	$750,400	435	$371	650,396	$750,771

United States Exports of Hydraulic Cement, June, 1930

	1930		1929		Per cent 1930 over or under 1929	
	Bbls.	Value	Bbls.	Value		
June	82,077	$ 223,639	96,055	$ 287,612	Minus 15	Minus 22
6 mos.	416,136	1,490,855	424,759	1,469,050	Minus 9	Minus 1

Modern Quarrying Methods Produce Cement Rock at Low Cost

Quarrying Costs Range from 26.5 to 32 Cents Per Ton in Louisville Cement Company's Quarries at Speed—Less Than One-Fourth of 1897 Figures, with Wages Four Times the Former Scale—A Triumph for Mechanical Equipment—Crushing Plant Also Operates Economically

By H. D. BAYLOR
Vice-President and Works Manager, Louisville Cement Co.

Seldom has the triumph of modern industrial equipment over old hand-labor methods been demonstrated more clearly than in the story here told.

In 1897, with quarry wages averaging 13.8 cents per hour, it cost the Louisville Cement Company more than four times as much to quarry its raw material as it did in 1929, when wages were four times the former scale. In 1897 the labor costs alone averaged 80.5 cents per ton, compared with from 9 to 13 cents per ton in 1929.—The Editors.

THE Speed portland cement plant of the Louisville Cement Co. was erected in 1906. By test-pitting and core-drilling it had been found that 40 ft. of the 60 ft. of Jeffersonville limestone underlying the deposit of Silver Creek limestone employed in the manufacture of the mason's cement sold under the name of Brixment was suitable for portland cement. A 20-ft. ledge of this stone was opened up. This ledge consisted of four 5-ft. ledges each having a distinct parting seam. Later, as the portland production increased, an additional 20 ft. of quarry was opened immediately below the original 20-ft. ledge of portland rock. Below this 40-ft. level the Jeffersonville limestone is not suitable for portland cement manufacture, but might be used for commercial stone.

Geology

Rock from this quarry consists of the Silver Creek limestone and Jeffersonville limestone members, of the Devonian age, as shown in Figure 1. The Silver Creek formation is 16 ft. thick and consists of a fine-grained, bluish to dark gray, argillaceous limestone. The Jeffersonville, lying below the Silver Creek, is 60 ft. thick, ranges from white to bluish and buff in color, and is a coarse grained, cherty argillaceous stone. A noticeable feature of both formations is the absence of caves, fissures, slips, sink holes, and mud seams, except on the surface immediately below the clay. All ledges lie in a horizontal position, and there are free parting seams between all beds. This parting forms a remarkably level quarry floor and excellent working conditions for track and shovel operation. Table 1 gives the chemical analyses of the various beds.

TABLE 1

Chemical Analyses Chart (See Figure 1)

	SiO_2	R_2O_3	Fe_2O_3	Al_2O_3	$CaCo_3$	$MgCo_3$
Overburden (clay) 8-ft.	67.98	19.53	7.62	11.91	10.45	5.72
Silver Creek limestone, 4-ft.	10.50	5.66	—	—	64.54	19.72
Silver Creek limestone, 4-ft.	16.20	6.72	—	—	54.63	22.83
Silver Creek limestone, 8-ft.	14.32	6.90	—	—	61.75	17.48
Jeffersonville limestone, 5-ft.	15.04	2.00	—	—	77.19	5.77
Jeffersonville limestone, 5-ft.	3.26	.70	—	—	90.81	4.64
Jeffersonville limestone, 5-ft.	3.60	1.54	—	—	92.22	3.64
Jeffersonville limestone, 5-ft.	4.46	.48	—	—	91.04	4.02
Jeffersonville limestone, 5-ft.	2.64	.58	—	—	94.65	2.13
Jeffersonville limestone, 5-ft.	5.40	.74	—	—	91.51	2.35
Jeffersonville limestone, 5-ft.	.74	.54	—	—	93.33	5.39
Jeffersonville limestone, 5-ft	3.56	.30	—	—	50.64	18.24
Jeffersonville limestone, 20-ft.	30.60	1.77	—	—	46.46	21.17

Methods of Prospecting and Exploration

Preliminary exploration in this quarry was accomplished by means of test pits in and near our present operation. Later on a diamond core drill was used and an accurate record kept of the findings. There are no records available on these core-drilling costs, however.

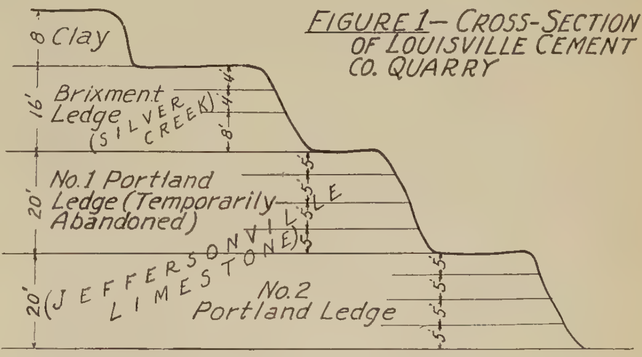


FIGURE 1—CROSS-SECTION OF LOUISVILLE CEMENT CO. QUARRY

Sampling

Samples of the crusher run of rock are taken daily and a weekly analysis is run. The rock analysis over a year's run shows very little variation. The overburden, which is clay, has no value at present.

Choice of Method

The horizontal position of the limestone ledges under a comparatively light and easily handled overburden made the choice of open quarrying automatic. When the need for portland rock arose, those ledges of Jeffersonville limestone uncovered by the removal of the Brixment stone offered an ideal source of raw material at a minimum of expense. A second bench in the original quarry was opened in the floor, taking the upper 20 ft. of the Jeffersonville limestone and later as the demand for stone increased a third bench was opened, taking a second 20 ft. of this stone. As a result, the quarry now supplies an average of 9 tons of stone per ton of overburden removed. As will be noted from the quarry plan and internal track layout (Figure 2) the quarry faces are all carried in the arc of a circle. Experience has proved that better fragmentation results when breaking from a circular face than when blasting the stone in a straight line.

Drainage

The drainage problem is taken care of by means of a 4,000-gallon per minute sump pump direct-connected to a 100-hp. motor. The drainage area surrounding the quarry takes in about 200 acres. Very little trouble is experienced with water. This lower quarry floor has about 1 per cent dip to the west and sump is located at the lowest point. In wet weather water accumulates in the western edge of this lower floor and quarrying in this section is abandoned until dry weather sets in.

Quarrying Methods

Stripping.—The 8-foot clay overburden has at present no commercial value. It is removed and hauled to a waste dump. The clay is dug with a railroad-type steam shovel, equipped with a 2½-cubic yard dipper. The shovel is moved on sections of 70-pound rails ranging from 5 to 7 feet in length. The stripping crew of 17 men consists of an engineer, craneman, and fireman on the shovel; four pitmen; a foreman; a locomotive engineer; a brakeman; and six dumpmen. The shovel loads the clay into 5 cubic-yard 2-way dump cars handled in trains of 10 cars. These cars are hauled to the dump, a distance of ¼ to ¾ mile and averaging ½ mile. The dump track was built on one slope of a ravine running to the west of the quarry and has been lengthened until it is now approximately ¼ mile in length and 30 feet high. This dump will handle about 32 hours of stripping without any movement of track.

Stripping is intermittent throughout the dry seasons of the year, inasmuch as the portland quarry rock production is such that 3½ to 4 days' operation give the required tonnage for the week. These portland quarry operators are then used on the stripping operation for the balance of the week. This switching of men makes it possible for the portland quarry crews to have steady employment. During 1929 stripping operations lasted 613 hours with an average removal of 157 tons per hour, or 1,256 tons per 8-hour day.

Brixment Quarry.—As previously noted, the Brixment quarry removes the first ledge of Silver Creek limestone and is shown in Figure 2. This ledge has an average production of 656 tons per 8-hour shift. The quarry has a steam shovel equipped with a traction crawler outfit and a 2½-cubic yard dipper. Three men are used on the shovel, as on stripping, besides one foreman, one jackhammerman, and one pitman. Six-yard cars are used in trains of 9 cars each, which are hauled to the plant by means of an 18-ton locomotive. All rock from this ledge is used, with no waste handling necessary.

Portland Quarry.—The first 20-foot ledge of Jeffersonville limestone uncovered by the advance of the Brixment quarry was abandoned in December, 1927. This quarry face includes about 70 acres stripped and ready for quarrying (Figure 2). As previously worked, one steam shovel

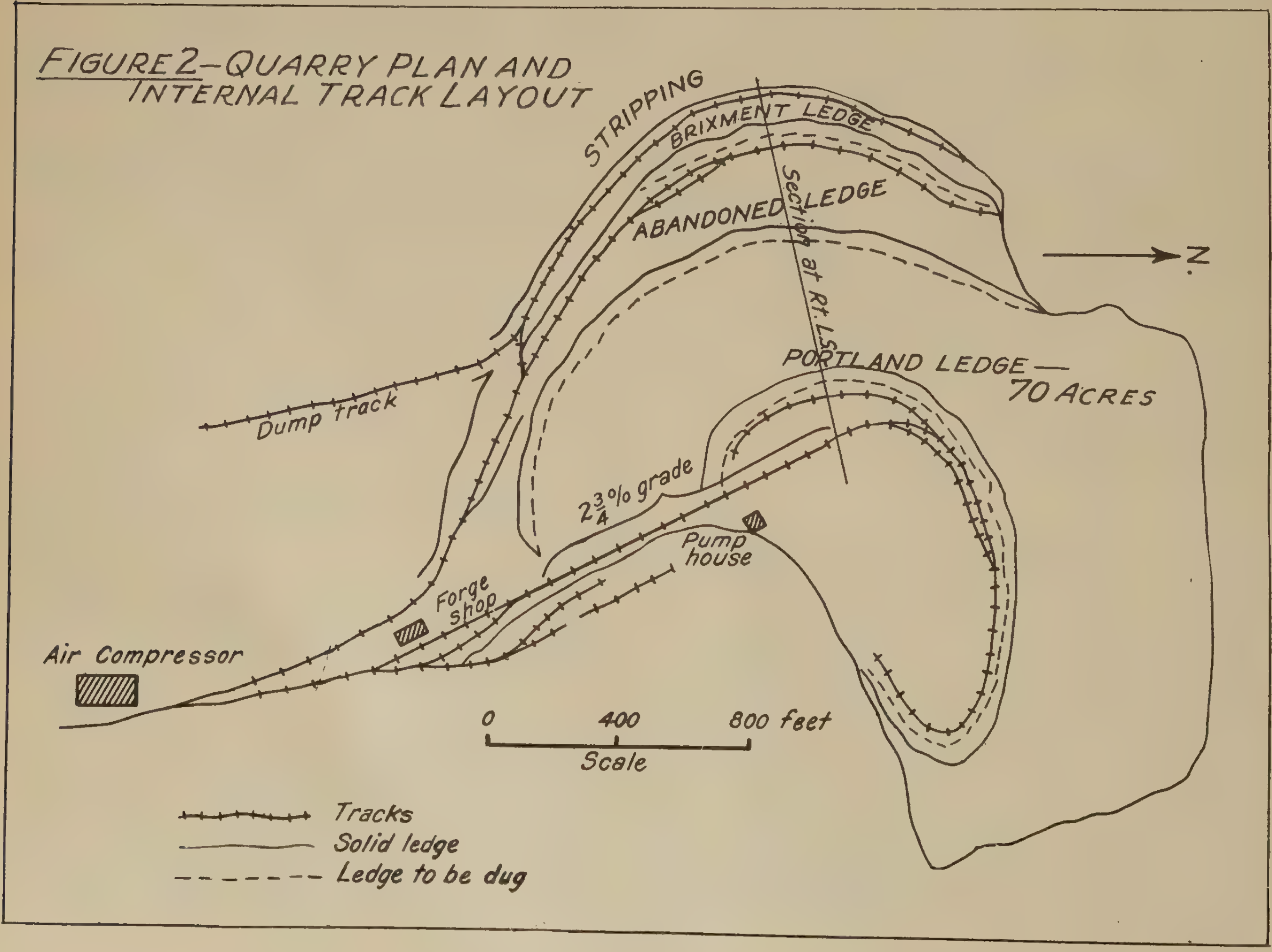


FIGURE 2—QUARRY PLAN AND INTERNAL TRACK LAYOUT

operated on this ledge, but when the lower ledge was opened the old shovel was removed to the lower level and another similar shovel added. This system made a more economical operation, as one locomotive was eliminated from the operating schedule.

To work this lower ledge economically it was necessary to construct a grade of 2¾ per cent about 2,000 feet long into the quarry. Originally there were two grades, one 1,500 feet long about 4½ per cent and another 1,200 feet long about 5 per cent. This new grade shortened the haul from the quarry about 700 feet and made it possible to use a 9-car train where before only a 6-car train had been used.

The two shovels in this lower quarry operated 1,445 and 1,453 hours, respectively, during 1929, with a total tonnage of 309,910, an average of 107 tons per hour per shovel. Both of these shovels have a crew of three men on the shovel and a foreman and block-hole driller in the pit. Each was formerly a railroad-type shovel but both are now equipped with traction crawler outfits. This quarry has a 20-foot face about 3,300 feet long in the arc of a circle. There are about 50 acres of this quarry opened up and about 20 acres remain to be quarried before the abandoned upper ledge is reached.

Drilling and Blasting

Brixment Quarry.—The primary holes on the Brixment ledge are drilled with one drifter mounted on a 4-wheel wagon (Figure 3). This is a piston drill operating on compressed air at 90 pounds per square inch at the drill. The drill will cut 250 feet of 2-inch holes per 8-hour shift. This drill has been found very adaptable to the low ledge method used in this quarry.

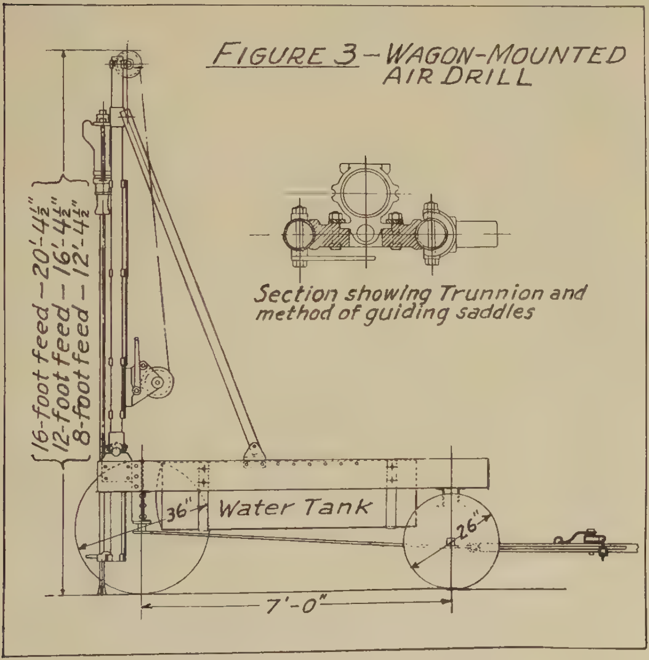


FIGURE 3—WAGON-MOUNTED AIR DRILL

The drifters were installed as wet drills but it soon became apparent that greater footage could be obtained by using them without water. This quarry now averages 200 feet per 8-hour day per drill with a spacing of 7 by 8 feet, which gives a drilling duty of 940 tons per drill, or 2.3 times the tonnage of the older type of turntable drills formerly employed.

A 1¼-inch hollow round drill steel with four changes of bits, 5, 10, 15 and 20 feet in length, is used. These are 4-point, 15-degree bits and are gauged from 2¾ to 2¼ inches. Two lines of holes are drilled on a 7 by 8-foot spacing, and the back line holes are staggered between holes of the front line.

Portland Quarry.—The portland primary drilling is handled similarly to that on the Brixment ledge, and hole spacings are the same. However, there are two drifters on this ledge. The two drills are handled by two drillers and one helper. These drills will average 200 feet each per 8-hour day. From 90 to 100 holes are shot simultaneously.

Drilling costs average 5 cents per foot of hole, including power. Repair costs average $0.0014 per foot of hole; 40 and 60 per cent dynamite in 2 by 18-inch cartridges are loaded in column loading. Shots are made by electric exploding machines of the hand operated magneto type.

In secondary blasting all large rocks are drilled by means of jackhammers and then shot with 40 per cent dynamite. There is no means of accurately knowing the ratio of stone broken by secondary blasting to that by primary, but for both ledges it is estimated that 3 per cent of the primary blast is block-holed and shot in the secondary blasting. All rock from this quarry is used in the manufacture of portland cement.

Transportation

The production from the portland quarry is transported to the plant in trains of nine cars each by three steam locomotives of 33-ton, 18.5-ton and 15-ton sizes. Two of these locomotives are used on the main lines for hauling to and from the quarry and the third is used in the pit for spotting cars for the shovels and switching loads and empties to and from shovels. There is a total of 1¾ miles of double track from the plant to the quarry. One locomotive is used for transporting rock from the Brixment quarry. The internal quarry trackage system may be seen in Figure 2.

A track foreman and six men maintain the track in the quarry, on the waste dump, and on all main lines to the quarry, spending about 2 days per week on quarry tracks, 1 day on main lines and Brixment tracks, and 3 days on the dump.

Small Tractor-Mounted Shovel Cuts Clean-Up Costs

During 1928, 5,262 man-hours of labor, costing $2,631, were employed in cleaning quarry floors after the passage of loading shovels. During 5 months of 1929 this expense had increased to 3,118 man-hours, costing $1,559.

To decrease this expense a small 3/5-yard shovel, mounted on a tractor, was bought at a cost of $3,000. In 1929 and 1930, this unit has more than repaid its cost in clean-up work and on construction excavation around the plant.

Crushing Plant

The Brixment crushing plant consists of a 36 by 48-inch Traylor Bulldog jaw crusher, belt-driven by a 125-hp., 3-phase, 60-cycle, 700-r.p.m., 440-volt motor. The rated capacity of this crusher is 100 tons per hour. No secondary crushing is necessary in this operation, and the discharge is less than 7 inches in size.

The portland crushing plant consists of a gyratory crusher, inclined elevator, feed hopper, apron feeder, hammermill, vertical elevator, and shuttle belt. The gyratory crusher is a Gates No. 24, manufactured by the Allis-Chalmers Mfg. Co. It has a rated capacity of 600 tons per hour with a discharge setting of 4½ inches and is driven by a 200-hp., 3-phase, 60-cycle, 505-r.p.m., 440-volt motor through an Allis-Chalmers Texrope drive on 10-foot, 7½-inch centers. The material from this crusher dis-

TABLE 2

Summary of Quarry Costs Per Ton

	Stripping	Brixment	Portland
A. Labor			
Drilling		$0.0180	$0.0150
Blasting		.0075	.0075
Loading	$0.0450	.0742	.0423
Haulage	.0120	.0300	.0250
Miscellaneous	.0400		
Total Labor	.0970	.1297	.0898
Average tons per man per shift	110	65.6	85.6
Labor cost, per cent of total cost	60	41	28
B. Power and Supplies			
Explosives		$0.0300	$0.0419
Shovels	$0.0170	.0125	.0358
Locomotives	.0235	.0234	.0703
Air compressors		.0032	.0032
Drills		.0100	.0100
Pumps		.0005	.0005
Fuel (coal)	.0245	.0132	.0132
Overhead		.0175	.0300
Total cost	.0650	.1103	.2049
Cost Summary			
Labor cost	.0970	.1297	.0898
Stripping cost		.0254	.0254
Power and supply cost	.0650	.1103	.2049
Total cost per ton	$0.1620	$0.2654	$0.3201

Period covered	1929
Tons of overburden removed	96,520
Tons of Brixment rock produced	160,520
Tons of portland cement rock produced	309,910

charges into a 54-foot inclined belt elevator which has sixty 17 by 21-inch buckets on 24-inch centers. A 75-hp. spur gear speed reducer having a 3-to-1 ratio is used for driving this elevator, which is inclined at 75 degrees. The rock passes from the inclined elevator to the feed hopper, which has a capacity of 34 tons, and from there it is discharged onto an apron feeder that conveys it to a Pennsylvania hammermill, the only secondary crushing unit used. This process reduces the product to a material ranging in size from 1 inch to dust. This hammermill has a rated capacity of 300 tons per hour and is driven by a 200-hp., 3-phase, 60-cycle, 705-r.p.m., 440-volt motor direct-connected. A vertical elevator carries the discharge from the hammermill to a shuttle belt which discharges into the rock storage.

TABLE 3

Quarry Man-Hours of Labor

(Period covered, average month in 1929)

	Man-Hours Per Ton		
	Stripping	Brixment Rock	Portland Rock
Foremen	0.0120	0.0210	0.0156
Powder		.0119	.0149
Drillers		.0119	.0100
Shovel engineers	.0060	.0119	.0100
Shovel cranemen	.0060	.0119	.0100
Shovel fireman	.0060	.0119	.0100
Locomotive engineer	.0060	.0164	.0149
Locomotive brakemen	.0060	.0164	.0149
Drillers		.0212	.0134
Dump men	.0360		
Pit men	.0436		
Track maintenance	.0135	.0139	.0104
Shovel repair		.0045	.0034
Totals	.1351	.1529	.1275

Stripping, 17,670 tons removed in average month.
Brixment rock, 11,770 tons produced.
Portland cement rock, 28,860 tons produced.

TABLE 4

Crushing Cost Per Ton

	Brixment	Portland
Operating labor	$0.0270	$0.0136
Operating supplies	.0055	.0028
Repair labor	.0051	.0028
Repair supplies	.0060	.0100
Power	.0100	.0068
Overhead and depreciation	.0400	.0500
Totals	$0.0936	$0.0860

Wage Scale

All wages are paid on an hourly basis. The following tabulation will give a fair idea of the type of labor.

Position	Number in Quarry	Wage Per Hour
Engineers	3	$0.65
Cranemen	3	.55
Firemen	3	.52½
Foremen	3	.65
Drillers	3	.48
Trackmen	8	.43
Drillers	3	.58
Drill helpers	2	.55
Locomotive engineers	4	.58½
Brakemen	4	.48
Blacksmith	1	.72
Helper	1	.55
Car repairmen	2	.56

Note: The average hourly wage of the 40 men in the quarrying force is 53¾ cents.

Costs of Quarrying and Crushing

Itemized quarrying and crushing costs are given in Tables 2, 3 and 4. The unit figures indicate that very satisfying results are being obtained, both in the quarry and in the crushing departments. Furthermore, these quarrying costs of 26½ cents per ton in the Brixment quarry and 32 cents in the portland quarry in 1929 should be compared with this company's quarrying costs of $1.34 per ton in 1897, when the hourly wage scale of 34 of the 35 men in the quarry force ranged from 11 to 17½ cents. The remaining man received 25 cents per hour. The average hourly wage for the 35 men was 13.8 cents per hour. In 1929 the average hourly wage of the quarry force of 40 men was 53¾ cents, as previously stated.

In 1897 the total labor cost of quarrying stone averaged 60 per cent of the total cost of producing the stone. In 1929, with an average quarry wage scale nearly four times as much, the labor cost was 41 per cent of the total in the Brixment quarry and 28 per cent in the portland quarry.

Medusa Plant Reopens

All departments at the Medusa Portland Cement Company plant at Dixon, Ill., resumed operation on September 8th, after having been closed down since August 9th.

French Mill Ships in Bulk in Vessel Built for Purpose

Cement Loaded and Unloaded by Pumping System—Conveying System on Vessel Described—Concrete Pipe Plant One of Large Customers Served

THE manner in which a portland cement mill near Paris, France, ships bulk cement to its larger customers that are accessible to water transportation is described in a staff article in the August (1930) issue of *Cemento* (Barcelona). Shipment is made in a vessel built especially for this service, fully equipped for loading and unloading cement in bulk.

The article in *Cemento*, which describes the loading facilities at the cement plant and the handling installations on the vessel, as well as the receiving facilities at the concrete pipe plant of one of the customers of the cement mill, is given in the translation that follows:

We refer to the cement required for the manufacture of concrete pressure pipe by the important firm of Fibrociment de Poissy (a product similar to the Uralita concrete pressure pipe made in Spain), which is received by water transportation from the portland cement mill at Gargenville, owned by the well known firm of Poliet & Chausson and located on the banks of the Seine some 50 miles from Paris.

A vessel of 500 tons carrying capacity has been constructed expressly for this purpose. This special boat may be seen in Figures 1 and 2.

For the loading of the vessel an efficient conveying system of pumps and pipelines of Fuller-Kinyon manufacture has been installed at the cement plant. This system carries the cement to the vessel through any one of the hatches in the upper deck, which may be seen in Figure 2. Aside from the deck the construction of the vessel is entirely of steel plates.

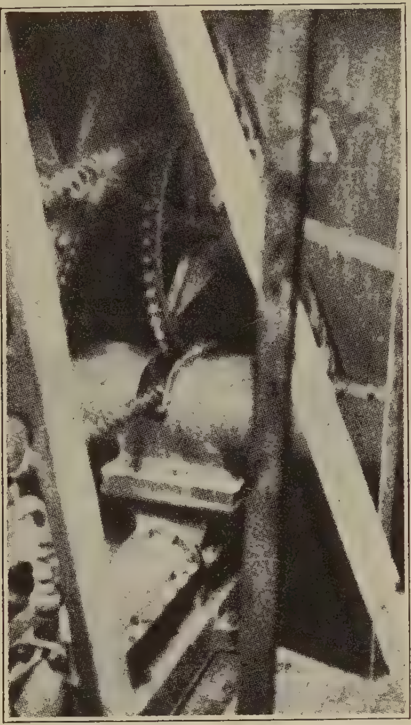


Figure 3. Conveyor-operating machinery aboard the vessel

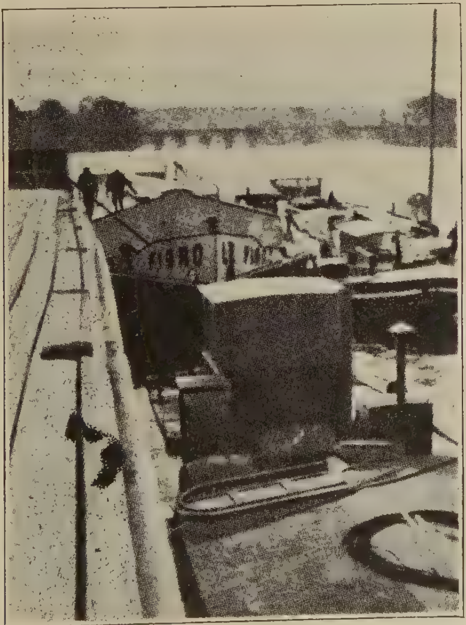


Figure 1. Vessel designed for bulk cement shipment from French cement mill near Paris

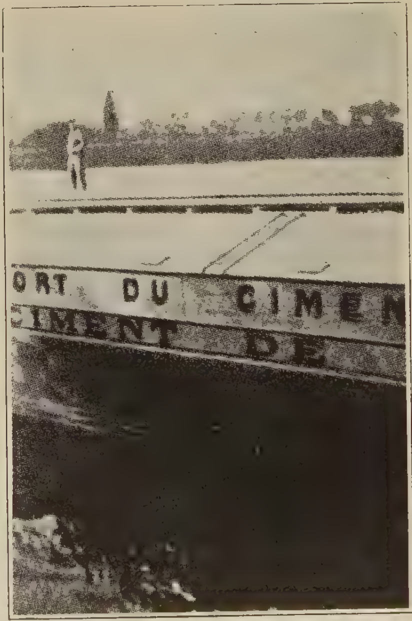


Figure 2. Cement is pumped in through the hatches in the upper deck

In this last illustration may be seen, likewise, a part of the two hoppers of which the vessel's construction consists, which are connected transversely at the point of emplacement of the unloading pump. This pump is fed by a worm conveyor perpendicular to the longitudinal axis of the vessel, which discharges directly into the pump just mentioned, a 6-inch Fuller-Kinyon. This pump then discharges into a fixed 4-inch pipeline extending as far as the level of the bridge of the vessel, from which point a flexible pipeline connects with the conveying system at the unloading wharf. This system then carries the cement to the storage silos located about 90 yards from the wharf and having a height of about 72 feet.

The interior part of the vessel consists of two compartments. In each compartment a conveyor moves along parallel to the longitudinal axis of the vessel, carrying the cement. The conveyor is operated by a geared wheel, as shown in Figure 3.

News of Tulsa Plant Shows Progress Being Made

Progress is being made by the Missouri Portland Cement Co. in closing deals for the purchase of acreage necessary for the plant site south of Dawson, Oklahoma.

To date, the company has a $25,000 investment in plant and quarry acreage, and the amount probably will be increased to $50,000 as the final details of sale are completed for land on which the company now holds options. Examination of abstracts is now in progress.

Fifty-three acres are being purchased at the plant site, 30 of which it is estimated will be required for the plant proper, the remainder to be used as the source of shale supply. A tract of 445 acres has already been purchased east of Garnett on the Frisco railroad for the limestone quarry.

The plant acreage is being bought from the Industrial Corp., a company formed by a number of local financiers to block up industrial acreage for sale to industries. The first actual purchase by the Missouri Portland company was made shortly after the announcement was made in June that a cement plant would be built, the original payment amounting to approximately $16,000.

Two officials of the company visited Tulsa late in August on business in connection with the project. They were P. H. Blaise, general superintendent of all plants, and E. M. Stevens, mechanical engineer.

Geoff A. Saeger, chemical engineer, has begun the work of taking out samples of limestone and shale at the two sites to be shipped to Kansas City for chemical tests at one of the company's plants there.

Hiram Norcross, president, is now in Europe studying cement manufacturing methods.

It is not anticipated that excavating for the Tulsa plant will get under way before January 1st, and it is predicted nine months will be required for completion. It is estimated the Tulsa plant will cost $2,500,000, and, when completed will furnish employment to 250 men.

Claims Eastern Coal Rates "Beyond All Reason" at Hearing

That eastern coal rates "are beyond all reason" was the charge made by E. S. Gubernator of the Lehigh Portland Cement Company, when he presented statistics at the Interstate Commerce Commission freight rate hearing at Washington, D. C., on September 10th.

"Coal rates in eastern trunkline territory as a class are the highest coal rates found east of the Rocky Mountains, including western trunkline territory, central and Illinois territory," Mr. Gubernator declared.

He submitted statistics he had completed showing comparisons of eastern rates with those charged in other territories, together with voluminous charts and data on distances, hauls and differentials.

Containers Used in Exporting Cement

By A. C. BLACKALL

For many years British cement exporters shipped their product abroad in either jute or hessian bags or in casks. Economies were so keenly practiced that the bags became so weak that the contents could percolate through during ocean transit, while barrels frequently gave way under the strain of the weight of other packages stowed above. In late years paper bag containers have become generally adopted. These, for exoprt use, are very well made and have for a long time past resisted damage caused by crushing and leakage. Hooks, of course, are prohibited. This made little difference owing to the small size of the bags. Lately, however, the competition has touched even paper bags, with the result that exports from continental ports (in competition with those from the Thames and Mersey ports, particularly London and Liverpool) are bringing out results on delivery at destination which compare poorly in many instances with those contained in the paper bags specially designed originally for efficient conduct of the traffic.

Group Insurance Plans Effected in Universal Atlas Plants

Group life insurance for men up to 70 years of age without medical examination is now being offered to Universal Atlas Cement Company employes.

The plan involved the formation of the Unat Cement Employes Insurance Association. While membership is wholly voluntary, the association now numbers approximately 95 per cent of the company's workers. A small initiation fee is charged for membership, after which monthly dues are deducted from the wages of the employes as long as they remain members of the association. An employe leaving the company has the privilege of transferring the insurance to another type.

The plan became effective August 1st.

Two New Cement Companies Organized in Mississippi

The Mississippi Portland Cement Company, recently organized at Jackson, Miss., has sites under consideration at Jackson and Macon for a $1,500,000 cement plant, from which unground clinker will be shipped to four division finishing and distributing plants in various parts of the state.

Charter has also been granted at Jackson to the Yazoo Portland Cement Co. of Vicksburg. Backed by a reported $2,500,000, the organizers plan to locate a cement plant in or near the latter place.

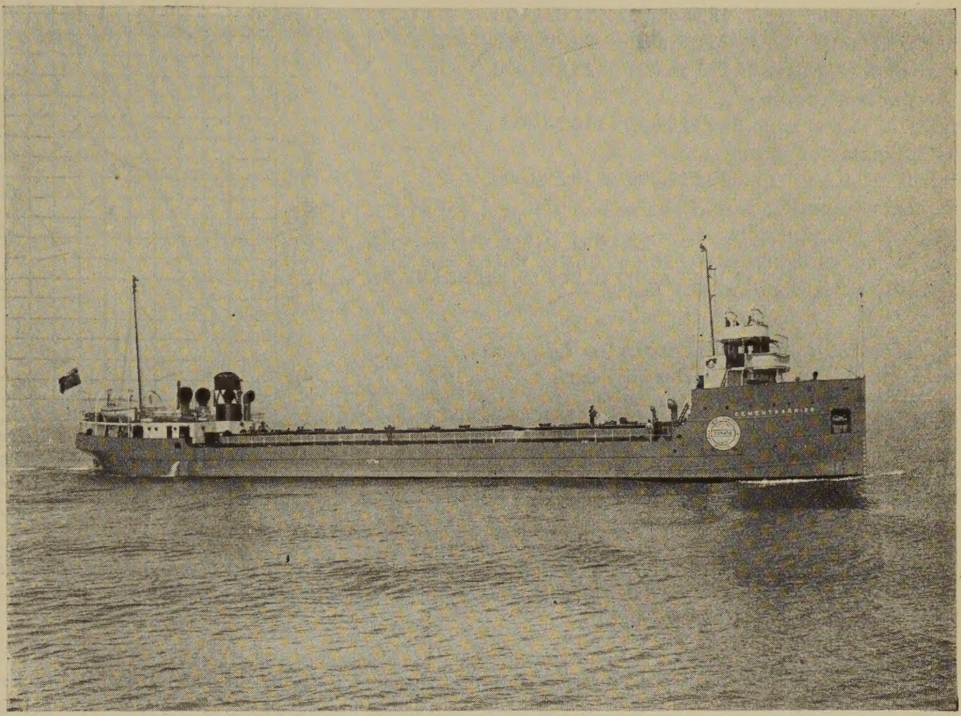
The proposed plant will utilize rock deposits on the east bank of the Mississippi river, north of Vicksburg.

R. S. Clark and R. C. Link of Memphis and H. C. McCabe of Vicksburg are the incorporators.

The organizers of the former company are W. S. Guest, Phoenix building, Birmingham, Ala., and B. R. Alford, Canal Bank building, New Orleans, Louisiana. The latter will have charge of erection of the plant.

Self-Unloading Equipment of Cement-Carrying Ship

Since the recent publication of the description of the self-unloading vessel "Cementkarrier," further details regarding the discharging gear have become available. The ship, recently completed in England for the Canada Cement Transport Company, was described in the September issue of CONCRETE, beginning on Page 96.



The diesel-electric motor-ship on the water. It was recently completed in England

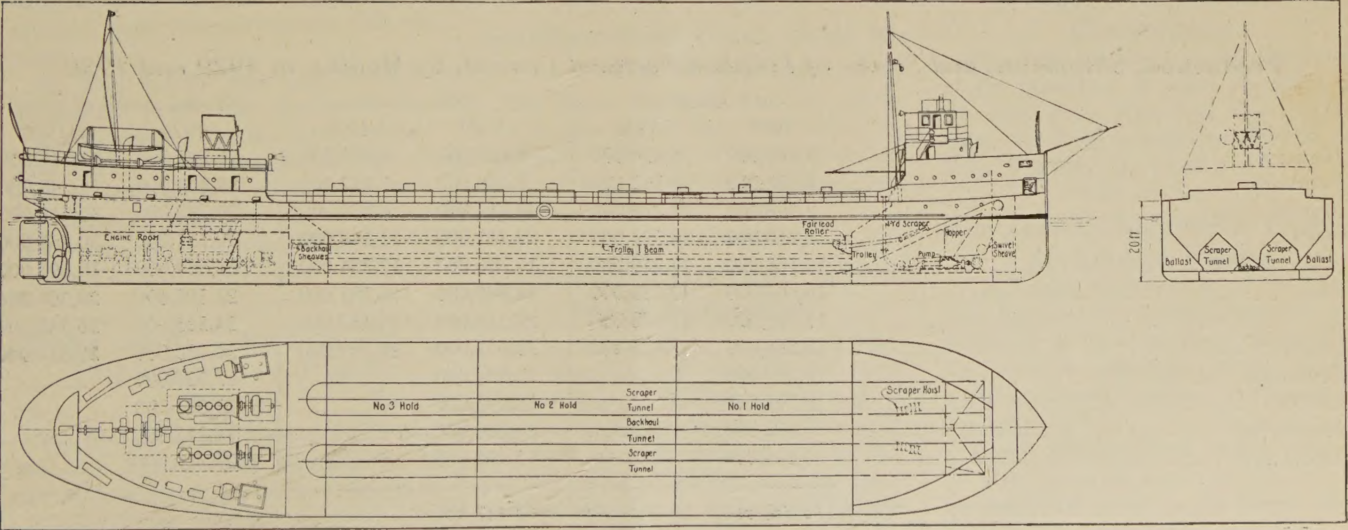
The unloading equipment consists of two longitudinal tunnels running the entire length of the ship, with one 4 cu. yd. Crescent scraper working in each tunnel. The bulk cement gains entrance to the tunnel through the openings on each side and is brought forward by the scraper and up an incline to the receiving hopper at the forward end of the ship. It is then fed to the 10 in. cement pump and discharged with the aid of compressed air through an 8-in. pipe to the storage silos located on the dock.

This unloading method, known as the Leathem D. Smith patented tunnel scraper system, was designed and installed under the direction of the Leathem D. Smith Dock Company, Chicago, Ill., which has installed similar unloading equipment in other lake and ocean vessels, including the steamship Bremerton, now being reconstructed at New Orleans.

Monarch Dividend

Meeting in its regular quarterly session at the home office at Humboldt, Kansas, on September 9th, the board of directors of the Monarch Cement Company declared a 4 per cent dividend, payable October 1st.

In the absence of President H. F. G. Wulf, Vice-President A. C. Kreitzer presided.



Detail views of the self-unloading "Cementkarrier," whose discharging gear is described in the accompanying article

Cement Statistics for August

Production and Shipments Both Down in August —Decline 4 and 12 Per Cent—Ratio of Production to Capacity Likewise Down

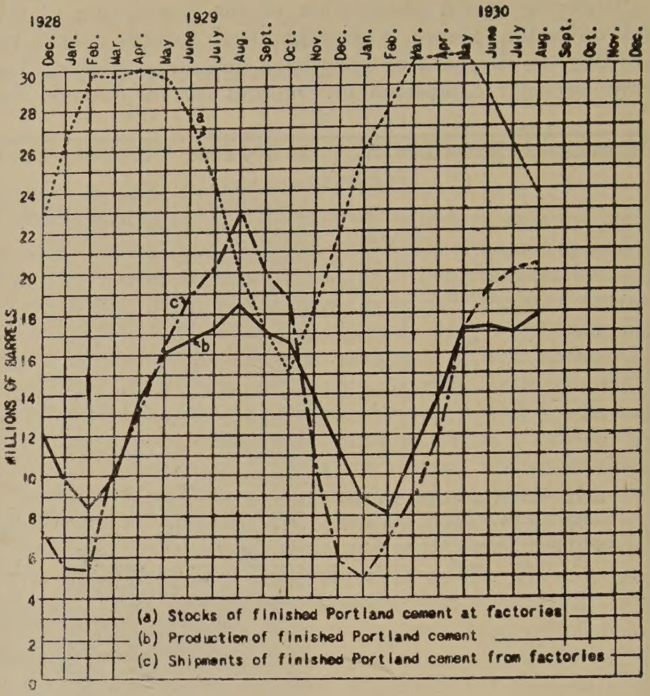
	1929	1930	Increase or Decrease(—), Per Cent
Production, August	**18,585,000**	17,821,000	—4.1
Shipments, August	**23,052,000**	20,299,000	—11.9
Stocks at end of August	20,056,000	**23,810,000**	18.7
Total production for year to date	**110,976,000**	110,793,000	—.16
Total shipments for year to date	**113,619,000**	110,590,000	—2.9
No. of plants reporting	164	**166**	1.2

NOTE: IN ORDER THAT THE READER MAY KNOW THE TREND AT A GLANCE, THE HIGHER FIGURE, WHETHER FOR EITHER YEAR, UNDER ANY CLASSIFICATION, APPEARS IN SLIGHTLY HEAVIER TYPE.

Relation of Production to Capacity

(Figures represent per cent)

	—August— 1929	1930	July 1930	June 1930	May 1930
The month	**86.1**	81.0	77.8	81.4	78.9
The 12 months ended	**68.2**	65.6	66.1	66.4	66.2



Production, Shipments, and Stocks of Finished Portland Cement, by Districts, in August, 1929, and 1930, and Stocks in July, 1930

District	Production—August 1929	1930	Shipments—August 1929	1930	Stocks at end of month 1929	1930	Stocks at end of July, 1930*
Eastern Pa., N. J. and Md.	**3,941,000**	3,676,000	**4,584,000**	4,161,000	4,777,000	**5,506,000**	5,992,000
New York and Maine	**1,449,000**	1,396,000	**1,747,000**	1,560,000	**1,467,000**	1,298,000	1,462,000
Ohio, Western Pa. and W. Va.	**2,180,000**	2,009,000	**2,464,000**	2,338,000	3,152,000	**3,194,000**	3,523,000
Michigan	**1,582,000**	1,426,000	**2,290,000**	1,627,000	1,238,000	**2,418,000**	2,618,000
Wis., Ill., Ind. and Ky.	**2,425,000**	2,409,000	**3,275,000**	3,045,000	2,318,000	**3,295,000**	3,931,000
Va., Tenn., Ala., Ga., Fla. and La.	**1,450,000**	1,232,000	**1,644,000**	1,328,000	1,623,000	**1,794,000**	1,889,000
Eastern Mo., Iowa, Minn. and S. Dak.	1,578,000	**1,933,000**	**2,589,000**	2,491,000	**2,081,000**	1,937,000	2,495,000
W. Mo., Neb., Kan., Okla. & Ark.	**1,430,000**	1,361,000	**1,773,000**	1,412,000	926,000	**1,637,000**	1,688,000
Texas	**707,000**	697,000	**786,000**	634,000	466,000	**627,000**	564,000
Colo., Mont., Utah, Wyo. and Idaho	**357,000**	302,000	**368,000**	292,000	**518,000**	510,000	501,000
California	**1,128,000**	922,000	**1,123,000**	961,000	997,000	**1,104,000**	1,144,000
Oregon and Washington	358,000	**458,000**	409,000	**450,000**	**493,000**	490,000	482,000
	18,585,000	17,821,000	**23,052,000**	20,299,000	20,056,000	**23,810,000**	26,289,000

Production, Shipments, and Stocks of Finished Portland Cement, by Months, in 1929 and 1930

Month	—Production— 1929	1930	—Shipments— 1929	1930	Stocks at end of month 1929	1930
January	**9,881,000**	8,498,000	**5,707,000**	4,955,000	26,797,000	**27,081,000**
February	**8,522,000**	8,162,000	5,448,000	**7,012,000**	**29,870,000**	28,249,000
March	9,969,000	**11,225,000**	**10,113,000**	8,826,000	29,724,000	**30,648,000**
April	**13,750,000**	13,521,000	13,325,000	**13,340,000**	30,151,000	**30,867,000**
May	16,151,000	**17,249,000**	16,706,000	**17,224,000**	29,624,000	**30,891,000**
June	16,803,000	**17,239,000**	**18,949,000**	18,781,000	27,505,000	**29,364,000**
July	**17,315,000**	*17,078,000	**20,319,000**	*20,153,000	24,525,000	***26,289,000**
August	**18,585,000**	17,821,000	**23,052,000**	20,299,000	20,056,000	**23,810,000**
September	17,223,000	....	19,950,000	....	17,325,000	....
October	16,731,000	....	18,695,000	....	15,381,000	....
November	14,053,000	....	11,222,000	....	18,213,000	....
December	11,215,000	....	5,951,000	....	23,550,000	....
	170,198,000	....	169,437,000	....	....	....

*Revised.

MEN and MILLS

Notes from the Field

Superior First Aid Team Takes First Place at Regional Meeting

The first aid team of Superior Portland Cement, Inc., Concrete, Washington, carried off first prize at the Northwest regional safety meeting held at the New Washington hotel, Seattle, Wash., on September 9th.

The first aid contest was sponsored by the Portland Cement Association and was conducted by John G. Schoning of the U. S. Bureau of Mines. Captains of the Seattle fire department acted as judges and H. H. Sanderson was recorder.

First prize was a handsome trophy donated by Mr. Sanderson. This is a perpetual trophy and will be placed in competition for nine years and at the end of that time will be given to the team whose name is inscribed upon it the greatest number of times.

Members of the team include Walter Jungblom, captain; John Bitonti, Frank Cinq-Mars, Carl Jungblom, Oscar Haussler, Ed Holbert, Jr., Blake Hall, and Howard Carleton, coach.

Bernt Chosen Manager of Penn-Dixie Boston Office

H. E. Bernt has been appointed district sales manager of the Boston office of the Pennsylvania-Dixie Cement Corporation. He succeeds E. G. Brick, who asked to be relieved of the responsibilities of that position. Mr. Brick, however, will remain with the corporation, his future duties giving him more frequent contact with the trade.

Mr. Bernt has for some time past acted as assistant district sales manager.

R. M. Penman, who has been connected with another cement manufacturer for the past 21 years in various sales capacities, has joined the same organization and has been appointed assistant district sales manager of the Boston office.

West Penn Foremen Back Publication of Plant Paper

The foremen of the West Penn Cement Company plant at West Winfield, Pa., at one of their recent group meetings, voted to undertake to continue the publication of the "West Penn Cement Safety News." This is an ambitious publication running about 16 pages and this action was taken to insure its stability.

C. P. Shaw is editor-in-chief. John Terry is business manager, and Herman Sankey is a contributor.

Studies West Penn Plant Refractory Problems

Himansu Kumar Mitra has for the past two months been a member of the technical staff at the West Penn company plant at West Winfield, Pa. He was engaged in research work on refractories.

Mr. Mitra is a native of India, having completed his college work in America, and is the author of several papers on ceramics.

Moyle Returns to Work After Illness

Richard Moyle has resumed his duties as general manager of the Marquette Cement Manufacturing Company at Oglesby, Illinois, after having been ill for almost a month.

Washington Bowling Team Gets Into Action

The 1930-31 bowling tournament for tenpins for members of the Superior Athletic Club at Concrete, Washington, will start about October 1st. It is expected that four teams of the local plant will enter, as follows: Quarry, mill, electrical, and office and laboratory.

Southwestern Plant Host to Foremen's Club

The Dayton Foremen's club was scheduled to open its fall and winter season on September 27th with a barbecue at the plant of the Southwestern Portland Cement Co., Osborn, Ohio.

Improved Road from Alpha Plant Is Opened

An improved traffic artery from the Manheim, West Virginia, plant of the Alpha Portland Cement Company was opened recently with the grading and widening of the road from Manheim to Rowlesburg and the laying of concrete from the latter point to the juncture of George Washington highway.

Dick Hardy Again Wins Cup in Association Tournament

With a low gross score of 135 for 27 holes Dick Hardy, of the administrative department at the general office of the Portland Cement Association repeated his performance of last spring by again winning the administration cup at the fifth annual fall golf tournament of the association on September 14th. W. D. M. Allan, manager of the cement products bureau of the association, was runner-up with a gross score of 137, giving him the low net score of 116 and the association cup as his prize, also for the second time. R. D. Brewer, office manager, won the putting prize with the low score of 29 putts for 18 holes. The proximity prize was taken by Art Dunn, of the Chicago district office, who placed his ball 18 feet from the pin on the short eleventh hole.

Scott Is Elected New Head of Keystone

Harold M. Scott was elected president of the Keystone Portland Cement Company at a meeting of the directors on September 8th. He succeeds the late John Barnes.

Mr. Scott has been associated with the industry for 25 years, having formerly been connected with the Lehigh, Edison and Atlas companies. He was general sales manager of the Atlas company until its acquisition by Universal early this year.

Appointed Chairman of Waste Prevention Committee

Wm. Pugh has been appointed chairman of the committee on waste prevention at the plant of the West Penn Cement Company. Mr. Pugh is chief electrician at the West Winfield, Pa., plant.

Electrical Engineers Guests of Lehigh Plants

The Lehigh Valley section of the American Institute of Electrical Engineers was scheduled to make an inspection tour of the research laboratory of the Lehigh Portland Cement Company at Ormrod on September 27th.

A talk, illustrated with motion pictures, on plant operation was to be followed by luncheon and a visit to the Sandts Eddy plant.

State Plant Commissioner Tells Business Club of Plant

A synopsis of the work of the South Dakota state cement plant at Rapid City, by H. P. Gutz of Selby, S. D., a member of the state cement commission, furnished the program for the weekly meeting of the Mobridge, S. D., Kiwanis club on August 28th.

"Backing his talk with a large number of facts and figures relative to the operation of the plant, Mr. Gutz's talk was very interesting and members of the club were given first hand information relative to the success of this state-owned industry," a local press report states.

Pension Credit Allowed 4000 Former Atlas Cement Employes

Full pension benefit for their whole period of continuous service with the former Atlas Portland Cement Co., will be extended to Atlas workers now continuing with the Universal Atlas Cement Co. This decision, according to announcement by the Universal Atlas company, places in line for pension benefits approximately 4000 former Atlas employes, many of whom thus get credit for twenty-five or more years of work with the former firm.

The United States Steel corporation pension fund, introduced in 1910 by the corporation and Andrew Carnegie jointly, was one of the first general pension plans established in American industry. Its benefits are apportioned according to a sliding scale based on wages and length of service. The new ruling means that former Atlas men will receive pension credit for continuous service including not only the period since January, but all continuous service with the former Atlas company.

The pension plan involves the retirement of men who have served twenty-five years or more, usually at age of seventy; by request, at sixty-five or thereafter; and at any age, through permanent incapacity.

Cowan Employes Complete First Aid Training Course

The Cowan, Tenn., plant of the Cumberland Portland Cement Company has joined the ranks of those that are 100 per cent first-aid trained. Classes in the first-aid training course of the U. S. Bureau of Mines, conducted by LeRoy Mowery, were concluded recently.

Manheim School Reopens

The Manheim, West Virginia, school reopened on September 8th, with an attendance of 90 pupils. Domestic science and manual training have been added to the subjects.

Universal Makes Changes in Treasurer's Office

The transfer of E. M. Johnson, assistant treasurer, from Pittsburgh to Chicago, and the appointment of A. B. Wells, assistant eastern credit manager at Pittsburgh for twelve years, to be assistant treasurer there, have been announced by T. E. O'Connor, treasurer of the Universal Atlas Cement Co.

Mr. Johnson became assistant treasurer of the company last year after twelve years as eastern credit manager and after twenty-three years' connection with the company. Prior to that time he was for several years with the Illinois Steel Co. He is no stranger in Chicago, having been assistant credit manager at the company's main office before going to Pittsburgh, and having previously done special advanced accounting work at Northwestern university. In returning to Chicago he succeeds A. J. Joyce, assistant treasurer, who recently resigned.

Mr. Wells has spent twenty-nine years in United States Steel corporation employ, twenty-one years being in the Universal Atlas office at Pittsburgh. Previously he was connected with the Carnegie Steel Co., and the H. C. Frick Coke Co.

With the Manufacturers

INDUSTRIAL LITERATURE

Amsco Pipe for Slurry Feed

Slurry feed pipes made of Fahralloy are told about in one of the items in the September issue of *The Amsco Bulletin*, published by the *American Manganese Steel Company*, Chicago Heights, Ill.

Cement mill operators, it is stated, are finding more and more applications for the metal because of its heat corrosion-resistant properties.

Fan Cooled Motors

From the Norwood, Ohio, works of the *Allis-Chalmers Manufacturing Company* comes a four-page leaflet descriptive of the important features of its totally enclosed fan cooled motors.

These features of simplicity, compactness, and strength are stated briefly and pictured in a number of views.

Manganese Steel Products

One of the recent publications of the *American Manganese Steel Company*, Chicago Heights, Ill., is a 4-page folder bearing first a form letter, then a double-page spread illustrating and briefly describing parts that have been manufactured of manganese steel, and lastly, a list of 20 questions regarding the properties and characteristics of the steel.

NOTES FROM THE FIELD

Burton Explosives, Inc., Begins Manufacture

Concurrent with the filing of a deed covering 418 acres of land near New Castle, Pa., announcement is made of the entry of *Burton Explosives, Inc.*, hitherto a sales organization, into the explosives and chemical manufacturing field.

J. S. Burton, president and general manager, formerly president of the Grasselli Powder Company, is quoted as stating that an initial production of 12,000,000 pounds of high explosives in 1931 is projected.

A plant to employ over one hundred men is now under construction on the site of the former American High Explosives Company, of which Mr. Burton was general manager at the time of a merger of the Burton Powder Company with Grasselli in 1917.

Manufacture of a line of heavy chemicals is proposed as a development to follow the establishment of the explosive line.

Headquarters of the company are in the Guardian Building, Cleveland, Ohio.

Hercules Men Receive New Appointments

Announcement of the appointment of *J. H. Horlick, Jr.*, as assistant director of sales, explosives department, of the Hercules Powder Company, has been made by *C. C. Gerow*, director of sales. Mr. Horlick has served for a number of years as manager of the service division, explosives department. In his new capacity he will take over the dutites of the late Fred F. Smith.

J. Barab will be the new service division manager, according to the explosives department's official announcement.

H. M. Lynch will continue to act as chief clerk and as assistant to Mr. Horlick.